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MASTER ERASMUS MUNDUS IN QUATERNARY AND PREHISTORY

PALEOPATHOLOGIES OF THE PREHISTORIC POPULATIONS OF ILLE CAVE (NORTHERN PALAWAN, PHILIPPINES).

A REAL CASE OF LABWORK ANALYSIS IN ARCHAEO-ANTHROPOLOGY.

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"The least questioned assumptions are often the most questionable."
– Paul Broca, founder of French Anthropology,
in his thesis of medicine. Paris, 1849.

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TABLE OF CONTENTS.

PROLOGUE: A PERSONAL HISTORY. WHY PREHISTORIC ARCHAEOLOGY? WHY PHYSICAL ANTHROPOLOGY?.....p.02.

CHAPTER 1. INTRODUCTION: THESIS STATEMENT AND GOALS…….p.06.

- **1.1.** DELIMITATION OF THE TOPIC OBJECT OF STUDY……..p.06.
- **1.2.** AIMS AND GOALS……...….p.08.
- **1.3.** THE DEVELOPMENT OF A LITERATURE REVIEW……...…p.08.

CHAPTER 2. ILLE CAVE FROM THE PERSPECTIVE OF THE PHILIPPINE PREHISTORIC ARCHAEOLOGY……..…….p.10.

- **2.1.** THE SPATIAL FRAMEWORK OF OUR STUDY CASE: THE ISLAND OF PALAWAN. GEOLOGY AND GEOMORPHOLOGY……..……p.10.
- **2.2.** THE ARCHAEOLOGICAL SITE OF ILLE CAVE: STRATIGRAPHICAL ANALYSIS, ABSOLUTE DATAS AND MATERIAL CULTURE…..….p.14.
  - 2.2.1. East Mouth trench…….p.16.
  - 2.2.2. East Chamber trench & East Mouth Connection trench……...p.20.
  - 2.2.3. East-West Connection trench……...p.21.
  - 2.2.4. West Mouth trench……...……p.24.
  - 2.2.5. West Mouth Connection trench……p.28.
  - 2.2.6. West Mouth West Extension trench…….p.28.
  - 2.2.7. Outlier trench……p.28.
  - 2.2.8. West Mouth Long trench……..p.29.
  - 2.2.9. Iihan trench……...……p.29.
- **2.3.** THE CHRONO-CULTURAL SEQUENCE OF ILLE CAVE……....p.30.

CHAPTER 3. METHODS OF LABORATORIAL ANALYSIS IN HUMAN OSTEOLOGY…….…..p.32.

- **3.1.** THE INVENTORY OF HUMAN REMAINS AND THE FINAL STUDY ASSEMBLAGE. MINIMAL NUMBER OF INDIVIDUALS (MNI).....p.32.
- **3.2.** STARTING LABORATORIAL PROCEEDINGS. CLEANUP OF HUMAN REMAINS…….……..p.35.
- **3.3.** INVENTORY, PHOTOGRAPHY AND PRELIMINARY MACROSCOPICAL ANALYSIS…….……...….p.39.
- **3.4.** SEX DETERMINATION……p.41.
- **3.5.** DETERMINATION OF THE AGE AT DEATH……...p.46.
  - 3.5.1. Degree of fusion of the epiphysis…….p.47.
  - 3.5.2. Fusion of the cranial sutures…….p.47.
  - 3.5.3. Eruption of the teeth…….p.48.
  - 3.5.4. Tooth wear analysis (Brothwell)……..p.49.
  - 3.5.5. Pubic symphysis surface……...p.50.
  - 3.5.6. Auricular surface of the ilium……...p.53.
- **3.6.** DETERMINATION OF PALEOPATHOLOGIES AND DIFFERENTIAL DIAGNOSIS……...p.55.
- **3.7.** MICROSCOPICAL ANALYSIS AND X-RAY: COMPLEMENTARY TECHNIQUES……p.56.
- **3.8.** THE DATA COLLECTION PROCESS AND THE CONSTRUCTION OF A FILE CATALOGUE…….p.58.

CHAPTER 4. THE RESULTS OF THE ANALYSIS. PALEOPATHO-LOGIES DOCUMENTED IN THE HUMAN REMAINS FROM ILLE……....p.59.

- **4.1.** INTRODUCTION: THE RESULTS OF SEX AND AGE DETERMINATION……p.59.
  - 4.1.1. Age estimation……..p.59.
  - 4.1.2. Sex determination……p.60.
- **4.2.** PALEOPATHOLOGIES REGISTERED IN THE ASSEMBLAGE…….....p.61.
- **4.3.** DENTAL PATHOLOGY……p.65.
  - 4.3.1. Periodontal disease. Root exposure, alveolar infection, calculus…….p.66.
  - 4.3.2. Carious lesions……..p.68.
  - 4.3.3. Ante mortem teeth loss (AMTL)……..p.69.
  - 4.3.4. Dental enamel hypoplasia (DEH/LEH)……p.70.
  - 4.3.5. Teeth wear: attrition and abrasion……p.71.

- **4.4.** NON-DENTAL PATHOLOGY……...p.78.
  - 4.4.1. Metabolic diseases. Cribra orbitalia…….p.79.
  - 4.4.2. Degenerative joint diseases. Osteoarthritis and Schmorl´s nodes……p.81.
  - 4.4.3. Infectious diseases. Osteomyelitis, periostitis and osteitis……...p.85.
  - 4.4.4. Trauma. *Ante mortem* fractures……p.89.
  - 4.4.5. Activity related stress markers…….p.95.

CHAPTER 5. INTERPRETING THE DATA COLLECTED: FINAL DISCUSSION AND FUTURE PERSPECTIVES……..p.97.

- **5.1.** INTERPRETATION AND CONTEXT OF ILLE CAVE PATHOLOGIES IN A GENERAL FRAMEWORK OF SOUTHEAST ASIAN BIOARCHAEOLOGY……p.97.
- **5.2.** DENTAL PATHOLOGY……p.98.
  - 5.2.1. Dental calculus and signs of buccal infection……..p.98.
  - 5.2.2. Dental caries…….p.99.
  - 5.2.3. Dental enamel hypoplasia (DEH/LEH)……..p.102.
  - 5.2.4. Non-masticatory tooth wear patterns and their possible cultural-functional implications…….p.103.
- **5.3.** NON-DENTAL PATHOLOGY…….p.108.
  - 5.3.1. Cribra orbitalia……p.108.
  - 5.3.2. Degenerative joint disease……..p.109.
  - 5.3.3. Infectious diseases……..p.110.
  - 5.3.4. Healed fractures (trauma)……...p.111.
- **5.4.** CONCLUSION: SOME IDEAS ABOUT THE HEALTH AND THE LIFESTYLE OF ILLE CAVE PREHISTORIC POPULATIONS……..…p.116.
- **5.5.** FUTURE PERSPECTIVES OF THIS LINE OF INVESTIGATION……...p.120.

BIBLIOGRAPHICAL REFFERENCES……..p.122.

ANNEX I. INVENTORY AND BONE DESCRIPTION FILES……....p.131.

- ✓ Context 67…….p.132.
- ✓ Context 484……...p.134.
- ✓ Context 703……...p.137.
- ✓ Context 727……...p.140.
- ✓ Context 755……...p.145.
- ✓ Context 800……...p.148.
- ✓ Context 907……...p.152.

- ✓ Context 1337……p.155.
- ✓ Context 1825……p.158.
- ✓ Context 2240……p.162.
- ✓ Context 2247……p.165.

ANNEX II. SEX AND AGE DETERMINATION FILES……...p.170.

- ✓ Context 67……p.171.
- ✓ Context 484……...p.173.
- ✓ Context 703……...p.174.
- ✓ Context 727……...p.175.
- ✓ Context 755……...p.178.
- ✓ Context 800……...p.180.
- ✓ Context 907……...p.182.
- ✓ Context 1337……p.183.
- ✓ Context 1825……p.185.
- ✓ Context 2240……p.187.
- ✓ Context 2247……p.188.

ANNEX III. REGISTER OF PALEOPATHOLOGIES FILES…….p.191.

- ✓ Context 67……p.192.
- ✓ Context 484……...p.196.
- ✓ Context 703……...p.202.
- ✓ Context 727……...p.207.
- ✓ Context 755……...p.214.
- ✓ Context 800……...p.218.
- ✓ Context 907……...p.221.
- ✓ Context 1337……p.223.
- ✓ Context 1825……p.227.
- ✓ Context 2240……p.231.
- ✓ Context 2247……p.233.

LIST OF PLATES AND CHARTS.

LIST OF PLATES.

- PLATE 2.1. *Location of Ille Cave in Northern Palawan Island, Philippines.***p.11.**
- PLATE 2.2. *Geological map of the Philippines archipelago (Philippines Bureau of Mines and Geosciences).***p.12.**
- PLATE 2.3. *Superior: geological map of Palawan. Inferior: detail of the Northern Palawan area (series 1:1000000 from the Philippines Bureau of Mines and Geosciences).***p.13.**
- PLATE 2.4. *Ille karst tower (Archaeological Studies Program).***p.14.**
- PLATE 2.5. *Photography of the base of Ille karst tower, in which both mouths can be appreciated, and vertical profiles of both entrances to the karst cavity (ASP, Emil Robles).***p.15.**
- PLATE 2.6. *Map of the excavation areas in Ille Cave archaeological site (ASP, Emil Robles).***p.16.**
- PLATE 2.7. *Neolithic burial from Ille Cave East Mouth trench, and detail of the ornamental manufactured shells (ASP).***p.17.**
- PLATE 2.8. *First cremation registered in Ille Cave East Mouth trench (LARA et al., 2013).***p.18.**
- PLATE 2.9. *Stratigraphical section of the North wall of the East Mouth trench (ASP).***p.19.**
- PLATE 2.10. *Stratigraphical section of the East wall of the East Mouth trench (ASP).***p.20.**
- PLATE 2.11. *Stratigraphical sections of the East Chamber trench (ASP, Emil Robles).***p.22.**
- PLATE 2.12. *Stratigraphical sections of the East-West Connection trench (ASP, Emil Robles).***p.23.**
- PLATE 2.13. *Stratigraphical sections of the East-West Connection trench (ASP, Emil Robles).***p.24.**
- PLATE 2.14. *Some examples of the post-Neolithic cemetery burials (inhumations). The absence of grave goods in this phase can be appreciated (ASP).***p.25.**
- PLATE 2.15. *Dog burial documented in the West Mouth trench (ASP).***p.26.**
- PLATE 2.16. *Stratigraphical section of the West Mouth trench (ASP).***p.26.**
- PLATE 2.17. *Stratigraphical section of the West Mouth trench in which both levels of the Middle Holocene shell middens (the ceramic in orange and the aceramic in yellow) can be appreciated (ASP).***p.27.**
- PLATE 2.18. *Burial under the "boat-shaper marker" documented in the West Mouth and detail of some of its grave goods (ASP).***p.27.**
- PLATE 2.19. *Stratigraphy of the West Mouth West Extension (WMWE) trench (ASP, Emil Robles).***p.29.**

- PLATE 3.1. *Diagram which displays the correct way of packing skeletal remains. We can appreciate the fact that the most heavy groups should be concentrated in the bottom of the craft, in order to preserve better the lighter ones in the top (From: University of Bradford, UK).***p.37.**
- PLATE 3.2. *Individual 2247 from Ille Cave, displayed over the work space in anatomical position.***p.38.**
- PLATE 3.3. *Photographic sequence taken during the process of bone cleaning: dry cleaning with wood stick (left and central images) and wet cleaning with brush (right).***p.39.**
- PLATE 3.4. *For the photographical register The use of artificial auxiliary lights, a uniformed color background and different measurement scales was also recurrent, in order to present as much information as possible in each series (right).***p.41.**
- PLATE 3.5. *Sexual dimorphism present between both genders in the skull and the pelvic griddle (From: WHITE, BLACK, FOLKENS, 2012, pp.409, 417).***p.42.**
- PLATE 3.6. *Sexual dimorphism in skull landmarks (From: WHITE, FOLKENS, 2005, pp.390-391).***p.44.**
- PLATE 3.7. *Some of the pelvic landmarks which present sexual dimorphism (From: WHITE, FOLKENS, 2005, pp.393-397).***p.45.**
- PLATE 3.8. *Variations in the shape of the pelvis preauricular sulcus between male and female individuals (From: BUIKSTRA, UBELAKER, 1994, pp.19).***p.45.**
- PLATE 3.9. *Diagram which displays the different ages of fusion for various skeletal elements, based on male individual (From: WHITE, BLACK, FOLKENS, 2012, pp.395).***p.48.**
- PLATE 3.10. *Location of the different cranial sutures (superior, left) and diagram which explains the different grades of fusion of them (superior, right). In the inferior charts, we can observe the age ranges expected trough the adding of values by the two different submethods (From: WHITE, BLACK, FOLKENS, 2012, pp.392).***p.49.**
- PLATE 3.11. *Dental development over Native American populations, according to Ubelaker 1989 (From: WHITE, BLACK, FOLKENS, 2012, pp.386).***p.50.**
- PLATE 3.12. *Tooth wear patterns related to age, from a sample of prehistoric-medieval skeletons from the UK, as in Brothwell 1981 (From: WHITE, BLACK, FOLKENS, 2012, pp.390).***p.50.**
- PLATE 3.13. *The Suchey-Brooks pubic symphysis scoring system, in which we can observe different status of degeneration of it surface for each gender (From: WHITE, BLACK, FOLKENS, 2012, pp.399).***p.52.**
- PLATE 3.14. *Modal changes to the auricular surface of the ilium within ages, as in Lovejoy et al. 1985 (From: WHITE, BLACK, FOLKENS, 2012, pp.400).***p.54.**
- PLATE 3.15. *The use of binocular lenses was especially useful during the laboratory analysis, especially for a first microscopical evaluation which didn´t pretend to get into deeper proceedings.***p.57.**

- PLATE 3.16. *Thanks to the connection of our reflex camera (Nikon D500) to the microscope, and trough USB connection to a computer, using the software of the own camera, we were able to prepare a microscope which would allow us to make our observations trough the computer screen in a more comfortable way, and also to take photographical series for documenting our work.***p.57.**
- PLATE 4.1. *Sample picture displaying the right mandibular molars from context 2247, in which we can observe calculus deposits (green arrows), root exposure (gingival margin before its recession marked in red) and the reactive alveolar bone around the dental insertions (between the yellow arrows).***p.67.**
- PLATE 4.2. *Carious lesions (pointed with green arrows) observed in the mandibular molars of the individual from context 755 (left images) and the right mandibular molars of the skeleton from 2247 (right images).***p.69.**
- PLATE 4.3. *Ante mortem tooth loss (AMTL) in the space left by the right third molar of the maxilla, part of the skeleton from context 1337 of Ille Cave. Can be observed that the remodeling process has been partially completed.***p.70.**
- PLATE 4.4. *A good example of the dental enamel hypoplasia in Ille Cave is the one presented in these images of the mandibular teeth of the individual from context 67. We can observe the DEH typical linear grooves marked with black arrows. A) LC, B) LPM1, C) RC, D) RPM1.***p.73.**
- PLATE 4.5. *Examples of the different levels of teeth wear registered in the assemblage: very light wear (context 67, mandible), light wear (context 755, mandible), advanced (context 1825, maxilla) and very advanced (context 727, mandible).***p.76.**
- PLATE 4.6. *Unusual wear pattern in the frontal teeth of the mandibles of the skeletal remains recovered in the context 755 and 2247. We can observe the lingual-labial oblique pattern of the erosion, especially noticeable in the case of 2247, and the rounded surfaces of the labial surfaces.***p.77.**
- PLATE 4.7. *Other microscopical markers of the studied unusual wear pattern in individual from the context 2247. In the left picture, we can observe two vertical microrotures. In the right side, longitudinal grooves caused by abrasion.***p.78.**
- PLATE 4.8. *Another unusual wear pattern displayed in the right molar pieces of the mandible of the skeleton from context 727. We can observe the oblique pattern, especially representative in lingual-buccal direction, as well as the advanced stage of teeth wear.***p.78.**
- PLATE 4.9. *Stuart-Macadam defined grades of progression of cribra orbitalia (grades 0-4), as explained in the main text: vid supra (From: NAVEED et al., 2012, pp.395).***p.80.**
- PLATE 4.10. *Signs of metabolic disease (cribra orbitalia) in the right orbit roof of the individual 800 from Ille Cave.***p.81.**
- PLATE 4.11. *Lateral view of the last lumbar vertebrae (L2-L5) of the individual from context 2247 of Ille Cave, in anatomical position. We can observe the marginal lipping in the frontal aspect of all the vertebral bodies, both in the upper and inferior edges.***p.82.**

- PLATE 4.12. *Superior view of a vertebral body of the cervical area of the individual from the context 727 of Ille Cave, in which we can observe the formation of new bone trough the presence of an osteophyte near to its posterior edge.***p.83.**
- PLATE 4.13. *Superior: Examples of X-Ray analysis overcome in live patients which display the Schmorl´s nodes (PENG et al., 2003, pp.880). Inferior: node registered in in the upper vertebral body of L2, individual from context 2247 of Ille (notice also the marginal lipping in the frontal edge).***p.84.**
- PLATE 4.14. *Superior: detailed pictures of the cloacae and involucrum registered over the left tibia and fibula of the skeleton from the context 703 (for the rest of the limbs, please, refer to Annex III). Inferior: cloacae observed during the X-Ray analysis of the bones which presented the condition.***p.87.**
- PLATE 4.15. *Image which exemplifies the areas affected by periostitis in the right femur of the individual 2247 of Ille (anterior view), with the characteristically pattern of new lamellar bone formation. For more images of other areas affected, please, refer to the paleopathological files (Annex III).***p.88.**
- PLATE 4.16. *Detailed pictures of the pubic symphysis of the individual from the context 2247, in which we can observe the degeneration of the bone surface and the complementary growth of new bone.***p.89.**
- PLATE 4.17. *Right nasal fracture of the individual from context 2247 from Ille Cave. We can notice in the images the misaligned healed fracture lines, and also de deviation of the septum.***p.91.**
- PLATE 4.18. *Anterior (left picture) and posterior (right) views of the left femur of the individual, in which we can appreciate the healed oblique fracture in the medial diaphysis, which was repaired in a misaligned position. In the X-Ray vision (anterior), the overlapping of fragments seems more visible (marked with white arrows).***p.92.**
- PLATE 4.19. *Proposal of reassembly of vertebrae and ribs of the individual from context 484, which displays the original position of the ribs during the bone alterations suffered after the trauma.***p.93.**
- PLATE 4.20. *External and internal view of the heads of the ribs from 3rd to 9th of the individual from context 484 of Ille Cave. The altered morphology, as a result of the process of bone remodeling, can be observed in every case, in the shape of flat projections, concavities (5th, 9th) and osteophytes (6th , for example).***p.94.**
- PLATE 4.21. *New bone formation over the acromion process of both right (A) and left (B) scapulae in our individual.***p.95.**
- PLATE 4.22. *Signs of new bone formation over both left (A) and right (B) clavicles of the individual from context 2447.***p.96.**
- PLATE 5.1. *Pictures showing two Inuit women performing an activity which implies the use of the frontal teeth as third hand: the chewing of animal skins. Below, dentition recovered from a prehistoric Eskimo site, in which we can observe the wear pattern left by this kind of activities (From: HINTON, 1981).***p.104.**

- PLATE 5.2. *Image of the wear pattern shown in the mandibular molars of the individual 61 of the archaeological Inuit site of Sadlermiut: similar to the case from context 727 of Ille, but in this case explained because the chew of hard-rubbery aliments (From: RAYE WOOD, 1992).***p.105.**
- PLATE 5.3. *Process of the preparation of betel nut (nga-nga) in Philippines: A,B) recovery of the areca catechu, C) preparation of raw materials (1: sliced nut without the pulp of the fruit, 2: including the pulp, 3: betel leaves or ikmo; 4: mascada or dry chewing tobacco leaves, 5: some lime or apog), D) chewing quid (From: author, over HENRY SCOTT, 1994).***p.106.**
- PLATE 5.4. *Archaeological-ethnographical comparison: up, reddish dentition of betel nut chewers from the Ifugao people (Banaue, Philippine Cordillera); down, and a sample case of a mandible proceeding from a prehistoric site in Palau, Micronesia (From: FITZPATRICK, NELSON, REEVES, 2003).***p.108.**
- PLATE 5.5. *Some examples of nasal fractures from the archaeological site of Coyo Oriente, Atacama Desert, Chile (pre-Tiwanaku). Notice the misaligned overlapping bonny fragments in the upper image, and the horizontal fracture in the inferior one, similar to our case of study (From: LESSA, MENDOÇA DE SOUZA, 2006, pp.135; TORRES-ROUFF, COSTA-JUNQUEIRA, LLAGOSTERA, 2005, pp.78).***p.112.**
- PLATE 5.6. *Superior: Batak hunter in the rainforest, performing hunt with spear (Copyright: Nigel Dickinson). Inferior: Batak women planting rice in a burned swidden field (Copyright: Tom Cornelly).***p.119.**

LIST OF CHARTS.

- Chart 1.1. *CULTURAL CHRONOLOGY OF ILLE CAVE (PAZ, 2012).***p.7.**
- Chart 2.1. *SEQUENCE OF CULTURAL DEPOSITION IN ILLE CAVE (as in PAZ et al., 2009).***p.31.**
- Chart 3.1. *LIST OF INDIVIDUALS FROM ILLE CAVE INITIALLY OMITTED FROM THE STUDY (CHRONOLOGICAL AND AGE REASONS).***p.33.**
- Chart 3.2. *CRANIAL LANDMARKS WICH PRESENT DIMORPHIC SEXUAL CHARACTERISTICS (BUIKSTRA, UBELAKER, 1994).***p.43.**
- Chart 3.3. *PELVIC LANDMARKS WICH PRESENT DIMORPHIC SEXUAL CHARACTERISTICS (BUIKSTRA, UBELAKER, 1994).***p.44.**
- Chart 3.4. *AGE RANGES IN THE AGE DETERMINATION PROCESS (BAKER et al. 2005).***p.46.**
- Chart 3.5. *DEGENERATIVE PROCESS IN THE SURFACE OF THE PUBIC SYMPHYSIS (as in BROOKS, SUCHEY, 1990).***p.51.**
- Chart 3.6. *CORRELATION OF THE CHANGES NOTICED IN THE PUBIC SYMPHYSIS AND THEIR AVERAGE AGE RANGES (as in BROOKS, SUCHEY, 1990).***p.52.**
- Chart 3.7. *STAGES OF DEGENERATION OF THE AURICULAR SURFACE OF THE ILIUM AND AGE RANGES ASOCIATED (as in LOVEJOY et al., 1985).***p.53.**

- Chart 4.1. *RESULTS OF THE AGE DETERMINATION PROCESS COMMITED IN OUR LABORATORIAL ANALYSIS*.**p.60.**
- Chart 4.2. *RESULTS OF THE SEXUAL DIAGNOSIS PROCESS COMMITED IN OUR LABORATORIAL ANALYSIS*.**p.60.**
- Chart 4.3. *ANALYZED PREHISTORIC INDIVIDUALS FROM ILLE CAVE WHICH DIDN´T PRESENT ANY PATHOLOGICAL CONDITION*.**p.61.**
- Chart 4.4. *PREHISTORIC INDIVIDUALS FROM ILLE CAVE THAT OFFERED POSITIVE RESULTS IN PALEOPATHOLOGICAL ANALYSIS*.**p.62.**
- Chart 4.5. *DENTAL PALEOPATHOLOGIES DOCUMENTED IN THE ANALYZED SKELETAL REMAINS FROM ILLE CAVE AND ITS DISTRIBUTION*.**p.63.**
- Chart 4.6. *NON-DENTAL PALEOPATHOLOGIES DOCUMENTED IN THE ANALYZED SKELETAL REMAINS FROM ILLE CAVE AND ITS ANATOMICAL DISTRIBUTION*.**p.64.**
- Chart 4.7. *DENTAL PATHOLOGIES DISTRIBUTION BY SEX AMONG THE INDIVIDUALS STUDYED*.**p.66.**
- Chart 4.8. *DISTRIBUTION OF DEH IN THE DENTITION OF THE INDIVIDUALS OF ILLE CAVE WICH PRESENTED THE PATHOLOGY*.**p.72.**
- Chart 4.9. *OCCLUSAL SURFACE WEAR SCORING RESULTS OF ILLE CAVE INDIVIDUALS (BASED ON BUIKSTRA, UBELAKER, 1994).***p.75.**
- Chart 4.10. *NON-DENTAL PATHOLOGIES DISTRIBUTION BY SEX AMONG THE INDIVIDUALS STUDIED*.**p.79.**
- Chart 4.11. *LOCATION OF OSTEOARTHRITIS MARKERS IN THE INDIVIDUALS FROM CONTEXTS 727 AND 2247 OF ILLE CAVE*.**p.82.**

ABSTRACT/RESUMEN/RÉSUMÉ/ RESUMO/SOMMARIO.

ABSTRACT.

This work, final thesis for the *Erasmus Mundus Master in Quaternary and Prehistory*, is configured as a bioarchaeological study conducted on human skeletal remains. The selected assemblage for the study comes from the archaeological site of Ille Cave (Barangay New Ibajay, El Nido), on the island of Palawan, Philippines. Of the various phases of burials documented on the site, was chosen to focus the study on those from the intensive burial phase (upper layers of the stratigraphic sequence), selecting individuals from prehistoric chronologies (Neolithic and Metal Age) and omitting therefore the individuals from the contact phase (colonial era).

This study established gender and age around the death of the 20 individuals selected, in addition to the detection of the various diseases suffered by the prehistoric inhabitants of Ille Cave (paleopathologies). For this purpose were used basic procedures for sexual diagnosis and age determination, widely used in forensic studies, as well as the differential diagnosis in the case of the study of diseases present in the human remains. Have been documented various types of diseases (infectious, degenerative, metabolic, trauma), both in the various bones composing the skeletons analyzed, as in the various teeth preserved in each case. Likewise, some markers of occupational stress where registered, related to various functions performed by individuals during their lives, and which have enabled to rebuild certain life activities of these communities (based on a comparison with other cases from the archaeological literature and ethnographic based studies).

Finally, the comparison of the results with others from various places in Southeast Asia has allowed the contextualization of Ille Cave case, which seems to follow similar patterns to those detected in this area.

RESUMEN.

El presente trabajo, tesis final del *Master Erasmus Mundus en Cuaternario y Prehistoria*, se configura como un estudio bioarqueológico llevado a cabo sobre restos esqueléticos humanos. La colección seleccionada para el estudio procede del yacimiento arqueológico de Ille Cave (Barangay New Ibajay, El Nido), en la isla de Palawan, Filipinas. De las diversas fases de enterramientos documentadas en el sitio, se ha optado por focalizar el estudio en aquellas procedentes de la fase de enterramientos intensivos (niveles superiores de la secuencia estratigráfica), seleccionando los individuos procedentes de cronologías prehistóricas (Neolítico y Edad de los Metales) y descartando, por tanto, los individuos procedentes de la fase de contacto (Era Colonial).

Este estudio ha permitido establecer el sexo y la edad en torno a la muerte de los 20 individuos seleccionados, además de recoger observaciones relativas a las diversas enfermedades que sufrieron los habitantes prehistóricos de Ille Cave (paleopatologías). Para ello, se emplearon procedimientos básicos de diagnosis sexual y determinación de la edad, ampliamente utilizados en estudios forenses, así como la diagnosis diferencial en el caso del estudio de las patologías presentes en los restos humanos. Se han documentado diversos tipos de enfermedades (infecciosas, degenerativas, metabólicas, traumatismos), tanto en los diversos huesos que componían los esqueletos analizados, como en las diversas piezas dentales conservadas en cada caso. Así mismo, se han conseguido determinar algunos marcadores de

estrés ocupacional, relacionados con diversas funciones llevadas a cabo por los individuos durante sus vidas, y que han permitido reconstruir ciertas actividades de la vida de estas comunidades (en base a un estudio comparativo con otros casos procedentes de la literatura arqueológica y a estudios de base etnográfica).

Por último, la comparativa de los resultados con otros procedentes de diversos sitios del Sudeste Asiático ha permitido la contextualización del caso de Ille Cave, que parece seguir patrones similares a los detectados en dicha área de estudio.

RÉSUMÉ.

Ce travail, mémoire de *Master Erasmus Mundus spécialité Quaternaire et Préhistoire*, est une étude bio-archéologique conduite sur des restes de squelette humain. L'assemblage choisi pour cette étude provient du site d'Ille (Barangay New Ibajay, El Nido), situé sur l'île de Palawan, Philippines. Des différentes périodes funéraires mises en évidence sur ce site, nous avons choisi de nous concentrer sur la phase funéraire la plus riche (couches supérieures de la séquence stratigraphique), en sélectionnant des individus des périodes préhistoriques (Néolithique et Age des Métaux) et en écartant les individus de la phase de contact (période coloniale).

Cette étude établit le genre et l'âge de décès des vingt individus sélectionnés et la détection de plusieurs maladies dont ont souffert les habitants de la grotte d'Ille (paléo-pathologies). Nous nous sommes appuyés sur une méthodologie classique de détermination des âges et des diagnoses sexuelles, méthode largement employé dans les études médico-légales, comme sur une étude des diagnoses différentielles des maladies présentes sur les restes humains. Plusieurs types de maladies ont été documentées (infectieuses, dégénératives, métaboliques, traumatiques) à la fois sur les différents os composant le squelette analysé que sur les dents. Des marqueurs de stress d'occupation ont été analysés, relatifs aux différentes activités accomplies par ces individus au cours de leur vie. Cela nous a permis de reconstruire les activités quotidiennes de ces communautés (nous nous sommes appuyés sur la littérature des études archéologiques et ethnographiques).

Enfin, la comparaison établie avec d'autres sites en Asie du sud-est a permis de remettre en contexte la grotte d'Ille qui suit les mêmes modèles.

RESUMO.

Este trabalho, tese final do *Mestrado Erasmus Mundus em Quaternário e Pré-História*, está configurado como um estudo realizado em restos bioarqueológicos de esqueletos humanos. A coleção selecionada para o estudo vem do sítio arqueológico de Ille Cave (Barangay New Ibajay, El Nido), na ilha de Palawan, Filipinas. Das várias fases de enterros documentados no site, optou por se concentrar o estudo sobre os enterros de fase intensiva (níveis superiores da seqüência estratigráfica), a seleção de indivíduos de cronologias pré-históricas (Neolítico e Idade do metal) e, portanto, descartando aqueles indivíduos da fase de contato (época colonial).

Este estudo estabelece sexo e idade em torno da morte dos 20 indivíduos selecionados, para além de coletar comentários sobre as várias doenças sofridas pelos habitantes pré-históricos de Ille (paleopatologias). Para esta finalidade, foram utilizados procedimentos básicos para a determinação da idade e diagnóstico do sexo, amplamente utilizados em estudos forenses, bem como o diagnóstico diferencial no caso do estudo das doenças presentes nos restos humanos. Foram documentados vários tipos de doenças (infecciosa, degenerativa, metabólica, trauma), tanto nos diferentes ossos que compor os

esqueletos analisados, como nos diversos dentes conservados em cada caso. Da mesma forma, consegueu-se identificar alguns marcadores de estresse ocupacional, relacionados com várias funções desempenhadas pelos indivíduos durante as suas vidas, e que permitiram reconstruir certas atividades da vida dessas comunidades (com base numa comparação com outros casos a partir da literatura arqueológica e de estudos etnográficos).

Finalmente, a comparação dos resultados com aqueles de vários lugares do Sudeste Asiático tem permitido a contextualização do caso de Ille Cave, que parece seguir padrões semelhantes aos encontrados nesta área de estudo.

SOMMARIO.

Questo lavoro, tesi finale del *Master Erasmus Mundus in Quaternario e Preistoria*, si configura come uno studio bioarcheologiche condotto su resti scheletrici umani. La raccolta selezionata per lo studio proviene dal sito archeologico di Ille Cave (Barangay New Ibajay, El Nido), sull'isola di Palawan, Filippine. Delle varie fasi di sepolture documentati sul sito, ha scelto di concentrarsi nello studio su quelli provenienti da fase di sepolture intensivi (livelli superiori della sequenza stratigrafica), selezionando le individui da cronologie preistorici (Neolitico ed Età dei Metalli) e scartando quindi, gli individui dalla fase di contatto (epoca coloniale).

Questo studio stabilisce sesso ed età intorno alla morte di 20 individui selezionati, in aggiunta alla raccolta di commento alle malattie che hanno colpito dagli abitanti preistorici di Ille Cave (paleopatologias). A questo scopo, sono state utilizzate procedure di base per determinare l'età e diagnosticare il sesso, ampiamente usato negli studi forensi, così come la diagnosi differenziale nel caso dello studio di malattie presenti nei resti umani. Sono stati documentati vari tipi di malattie (infettiva, degenerativa, metabolica, traumi), sia nei vari ossa qui comporre scheletri analizzati, come nelle varie denti conservati in ciascun caso. Allo stesso modo, sono riusciti a identificare alcuni marcatori di stress occupazionale, in relazione alle diverse funzioni fisiche svolte da individui durante la loro vita, e hanno permesso di ricostruire alcune attività di vita di queste comunità (sulla base di un confronto con altri casi dalla letteratura archeologica e studi di base etnografici).

Infine, il confronto dei risultati con gli altri provenienti da diversi luoghi nel Sud Est Asiatico ha permesso contestualizzare il caso di Ille Cave, che sembra seguire modelli simili a quelli rilevati in questo studio.

PALEOPATHOLOGIES OF THE PREHISTORIC POPULATIONS OF ILLE CAVE (NORTHERN PALAWAN, PHILIPPINES)

PROLOGUE: A PERSONAL HISTORY. WHY PREHISTORIC ARCHAEOLOGY? WHY PHYSICAL ANTHROPOLOGY?

Before discussing and defining the subject of work I did during my temporary stay in the UP Diliman (Philippines), as part of the Erasmus Mundus Master in Quaternary and Prehistory, it is necessary here to begin with a brief overview of my personal and professional history in reference to the two fields that come together in this issue: archaeology and physical anthropology (in this case referred to the osteological material).

Referring to the first field, the truth is I can say that archeology has been my passion since childhood, although this "life dream" was not formalized until the beginning of my studies in that disciplines, when in 2011 I decided to enroll in the Degree of History at the Faculty of Philosophy and Letters of the *Universidad de Alcalá de Henares* (Madrid, Spain). During the five years of this phase of my training, I not only learned to give a more scientific perspective to the study of history and archeology (as opposed to the myths of childhood), but I fell even more in love with the archaeology itself. Much blame it all comes from the constant effort of the Department of Prehistory of the university, led by Dr. Rodrigo de Balbin and Dr. Primitiva Bueno Ramirez, both great specialists concerning the archeology of the Iberian Peninsula (the first on hunter-gatherer societies, and especially in the study of Paleolithic art; the second in recent chronologies, megalithic and post-Paleolithic art specialist) also knew how to instill passion and respect in me for the discipline, through a certainly practical and fun way (annual study tours to archaeological reference sites, workshops for the study of materials, excavations, etc.). Thanks to them I ended up choosing to focus my studies in prehistory, although my previous interests pointed in other directions (Classical Archaeology, Egyptology, Islamic Medieval).

During the Degree I also had the opportunity to acquire various fieldwork skills through several seminars of documentation of rock art and many archaeological campaigns.

Certainly my first excavation was really important to further define my potential interest: it was a necropolis of pit graves from Chalcolithic and Bronze Age periods, situated on the outskirts of Madrid, and was carried out by a partnership with a company of archeology (Punto de Encuentro S.L.). In addition to the hardness of the work, I perfectly remember the feeling I had when first discovered human remains: the skeleton of a child, apparently bound and decapitated. In the adjacent pit, anthropologists exposed the remains of an adult male in an extended position and covered with multiple beads, forming a colorful necklace. My innate passion for the ritual and that first experience made me decide to focus my work on the archeology of death.

All these experiences led me to continue my studies after the Degree in History by specializing in the field of archaeology, which was manifested in the attainment of the Master AGEPIPE (Archaeology and Heritage Management at the Inner Iberian Peninsula: 2011-2012) in state institution, during which I was able to do my thesis on ritual contexts of Prehistory of my region. My work, "Pit graves from III to II millennia BC in the Inner Iberian Peninsula", would have been impossible without the invaluable help and direction of Dr. Rosa Barroso Bermejo, who helped me analyze the funeral phenomenon in the upper Tagus River, in the triangle formed by the provinces of Madrid-Toledo-Guadalajara.

While I consider it necessary to continue in my studies for the future (I have in mind my PhD in the subject), the development of my thesis in AGEPIPE made me consider many questions. The main one was “and what happens to the human remains?” My thesis was focused on the analysis of materials, structures and spaces, but the fact is that one of my biggest gaps after my time in the UAH was directly studying the skeletons themselves. Of course, this would have no place in a C.V. specializing in the study of tombs! Therefore, I decided to take some time to think before enrolling in a PhD program, and this time of reflection materialized in the enrolling for the Erasmus Mundus program which currently I´m doing. I had the good fortune to receive, at the end of 2013, a scholarship that allowed me to participate without major costs in the International Master in Quaternary and Prehistory. First, because it was a great opportunity to embark on that journey into the unknown: the study of physical anthropology. Second, I have always considered myself a traveling and adventurous person. My first Erasmus, conducted in the fourth year of the

Degree of History at the *Universidade de Coimbra* (Portugal), allowed me to understand how important it is to study in an international environment, with different ideas and methodologies, and of course with different languages. Also, the strong global economic crisis in which we find ourselves nowadays is forcing many young people to emigrate from my country in search of a better future: so it seemed logical to take advantage of circumstances to start looking for projects that were viable for my future.

It is with this second master that I come face to face with the second field of physical anthropology. During my stay at the *Instituto Politécnico de Tomar* and the *Museu da arte Pré-Histórica e do Sagrado no Vale do Tejo* in Mação, I had the opportunity to take a course of Bioarcheology and Human Evolution, led by Dr. Eugenia Cunha of the University of Coimbra, a great specialist in forensic science and great teacher, who knew how to guide us precisely in the various theoretical and practical exercises of the course.

My obsession to learn as much as possible about human bones also led me to participate in the laboratory of human osteology of the UP Diliman Archaeological Studies Program (hereinafter referred to as ASP), led by Dr. Rebecca Crozier, during a stay of four months in the summer of 2014. Through a month of work with a practical exercise that *a priori* might seem simple (the study of a skeleton in fairly good condition, defining the biological profile of the individual), Dr. Crozier got me interested in the secrets hidden behind the human remains increasingly, and made me understand the idea that somehow a deceased individual (hundreds of years in this case) could continue giving us really valuable information. This, together with the wonderful personal experiences that I enjoyed during my time in the Philippines and the ASP, led me to propose Dr. Crozier as director of my future thesis, which would deal with paleopathologies (even the exact issue was not defined yet) and could be done by a new stay in the country which would run between January and August 2015.

Overlooking my thesis preparation, I was able to make another mobility between October and December 2014 in the *Universita degli Studi di Ferrara* (Italy), where theoretical and practical studies were useful to me for my future work: a theoretical course on Human Paleontology and Paleoanthropology, headed by Dr. Carlo Peretto; and two courses, both theoretical (Biology of the Human Skeleton) and practical (laboratory of archaeo-

anthropology and forensic anthropology), with the recognized italian forensic scientist Dr. Emmanuela Gualdi. I was able to approach skeletal fragments in state of poor preservation, analyzing the pathologies reflected in the remains by comparing them with an extended reference collection, and also conducting studies of sexual diagnosis, age determination and stature.

For these reasons, it is clear that my master's thesis would be framed in the field of prehistoric archeology, particularly in funerary archeology, and especially in the study of human remains. The availability of Dr. Crozier and the fact that paleopathologies supposed a new path of research for me did the rest to defining the thesis topic which is proposed below (Chapter 1).

1. INTRODUCTION: THESIS STATEMENT AND GOALS.

1.1. DELIMITATION OF THE TOPIC OBJECT OF STUDY.

While was clear that the work was going to be focused in the study of a skeletal assemblage from a prehistoric site in the Philippines, now it was time to choose between the various options available: which would be the actual bone collection to study or on which build the proposed study? After several e-mails, Dr. Crozier proposed two different collections among those from the ASP archive: Catanauan (Quezon, Bondoc Peninsula) or Ille Cave (New Ibajay, el Nido, Palawan Island). Finally we chose the second case, because of the best status of preservation of the collection.

Although the following chapters will discuss in detail the archaeological case of Ille Cave (Chapter 2), it is necessary to provide a brief overview of the phase sequence of the site, as it was vital to define the topic of final work. As will be seen in Chart 1.1, it was possible to make a sufficiently robust analysis of stratigraphy and materials to offer a basic chrono-cultural sequence, either from some absolute dating or mainly by relative dating of the various layers and archaeological contexts. Chart 1.1 provides a good picture of said sequence (PAZ, 2012, pp.142-152). As we may deduct from the chronocultural scheme, two different funerary typologies have been observed at Ille Cave: cremations and burials. Since other teams in the ASP are already focusing their work on cremations (LARA *et al.*, 2013), was decided to eliminate them from the study.

As this project was focused on the analysis of prehistoric human remains, a sample of 20 burials from the earliest phase to the Metal Age phase were selected for study. Thus our efforts would focus on those first burials, the "Neolithic" stage and the period associated with metallurgy (marking a wide chronological range from more than 4000 years ago until c.1000 years ago). The truth is that the stratigraphy of the superior layers is quite chaotic, and the lack of absolute dating did not facilitate the work in this direction (Chapter 2): was

quite complicated to put a superior clear limit to the upper layers, in order to distinguish the limit between the prehistoric phase and the

Chart 1.1. CULTURAL CHRONOLOGY OF ILLE CAVE (PAZ, 2012).

CHRONOLOGY	CHARACTERISTICS
C.1400-C.9000 Y.A.	This phase doesn´t include any sing of human activity yet (just some wild animal remains).
C.9000-C.4000 Y.A.	This phase opens the human presence part of the sequence, including the cremation cemetery.
>4000 Y.A.	This phase includes the first two aceramic shell middens and also the first two inhumations in the sequence: context 874 and 727.
C.4000-C.2000 Y.A.	Another shell midden in which the ceramic starts to be present, the inhumation phenomenon continues.
C.2000-C.1000 Y.A.	Metal period sequence: appearance of the metallic implements, *lingling-o* amulets in jade and shell, more layers of shell midden.
C.1000-C.100 Y.A.	Phase of contacts, in which tradeware ceramics (China, Vietnam, Thailand) start to be present. Indopacific glass beads in some burials, but the ceramics are not associated to them. Colonial influence.
<100 Y.A.	Contemporanean populations.

colonial one. That's why a global analysis will be referred within this chronological framework, which could include some individuals of transitional moments.

Also, another researcher from ASP is currently examining the non-adult remains, so the analysis will focus in adult individuals, unless the evolution of the work would require us to expand the age ratio.

So then, we can state the thesis which I will present here as a study of the paleopathologies present in the adult human remains of prehistoric times (>4000-c.1000 years ago) of Ille Cave (Palawan, Philippines).

1.2. AIMS AND GOALS.

Once the thesis topic had been decided, it was necessary to outline the goals of the study:

- Assess the evidence for pathological lesions on the prehistoric human remains from Ille Cave, Palawan.
- Establish a laboratorial procedure that would help us to systematize the approach to each individual, and also develop a file system (catalogue) which would allow us to record and present the results of our analysis in a clear way.
- Determine the age and sex of each individual.
- The determination of the stature of the individuals is not part of the present study, since the preservation status of the assemblage made it impossible (missing or fragmented epiphysis of the long bones: BUIKSTRA, UBELAKER, 1994, pp.69-85; WHITE, FOLKENS, 2005, pp.398-400).
- Differential diagnosis of possible pathologies present in the collection to study.
- Establish, if possible, relations between the documented pathologies and other population factors (sex, age, possible activities, lifestyles, etc.) that could allow their explanation or understanding in a sociocultural context. Ethnographical resources would be really useful to answer this question.
- Establish also frequency relations of these pathologies with the ones present in other collections studied in other relevant sites in Southeast Asia.

1.3. THE DEVELOPMENT OF A LITERATURE REVIEW.

As in any scientific study, specifically of an archaeological nature, before the stage of laboratory work (Chapter 3) an investigation of the existing literature is essential: it is necessary to understand well the site under study, its chrono-cultural sequence, materials (not just osteological remains), their contexts (especially the funerary, and considering the stratigraphic relationship between them, what could allow the development of the said sequence of phases of Ille). “What is known about Ille Cave? What kinds of studies have been conducted? What results have been obtained?”

The documentary phase was initiated by the exhaustive search of the broadest possible literature about the site, its materials, its stratigraphy, dating, etc. Also, for ensuring the

understanding of the contexts in which the burials appear, the graphic documentation obtained during excavation (photography, drawing, mapping, stratigraphic relationships expressed by Harris Matrix, which were kindly provided by Drs. Paz and Lewis) was a great help.

As for the search of more specific literature, relating to work on human remains issues, knowledge of the subject by Dr. Crozier was fundamental: her extensive knowledge of written literature on working methods allowed to establish a basic bibliography of reference, on which later work would allow the location of new references and search for a more specific literature (for example, in cases of more specific diseases that were documented during the laboratory analysis of the collection). In that sense, the library of the ASP and the Central Library of the UP Diliman campus offered me all written sources in relation to the different aspects of work. Finally, the website of the UP library offered a very useful search tool organized by fields, also recurrent for developing own references (www.ilib.upd.edu.ph).

2. ILLE CAVE FROM THE PERSPECTIVE OF THE PHILIPPINE PREHISTORIC ARCHAEOLOGY.

2.1. THE SPATIAL FRAMEWORK OF THE STUDY CASE: THE ISLAND OF PALAWAN. GEOLOGY AND GEOMORPHOLOGY.

The island of Palawan (Philippines), in which the archaeological site of Ille Cave is located and which location is displayed in Plate 2.1, is part of the Visayas region, and is located on the Southwestern part of the archipelago, in the North of Borneo Island.

Geologically speaking, the island can be divided in two main groups (Plate 2.2): the Northern part of the main island (together with the Coron group) and the Southern half of it have completely different geological characterizations. While the Northern part deposits can be characterized as Paleozoic and Mesozoic base deposits, over which the intrusion of new materials and alteration of them will play a special roll in some areas (MÜLLER, 1991, pp.121-122); the Southern part of the main island is mainly composed with Cretacic, Tertiary and Quaternary deposits, which suffered different process within can be highlighted the intrusion of mafic materials.

Northern Palawan (Plate 2.3) is constituted mainly by Upper Paleozoic and Lower Mesozoic sediments, which in some regions suffered deformations and metamorphic process during the Early Jurassic era (YUMUL *et al.*, 2009, pp.612). Latter, this geological sequence suffered different intrusions of plutonic rocks, which caused subsequence overlain by sediments offshore (Eocene). All the Northern part of the main Palawan Island and the Calamian group can be defined, according to their composition, as uplifted basement limestone and chert. Also, some igneous groups contributed to this complex system with intruder materials in the Kapoas Peninsula, the Ulugan Bay and the Manguao volcanic area.

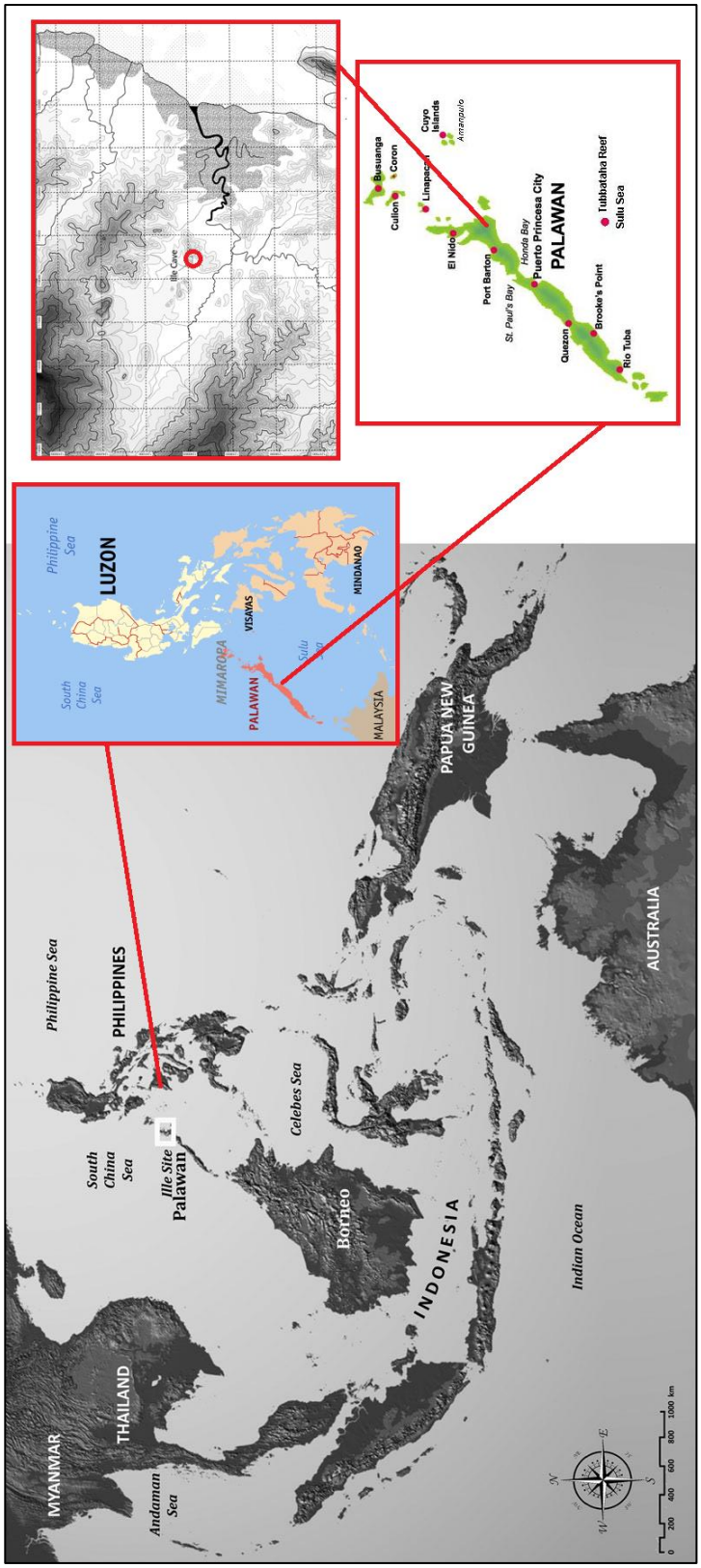


PLATE 2.1. Location of Ille Cave in Northern Palawan Island, Philippines.

The geology of Northern Palawan can also be divided in two main areas (YUMUL *et al.*, 2009, pp.612-613), which separate the complex in two main areas (again N/S) from Calauag Bay:

- In the Northern part (where Ille Cave site is located: section 2.2), the outcrops of Guinlo formation overlie the Busuanga formation, consisting in massive quartzose sandstones with episodes of conglomerates and mudstones. Possibly their origins can reach the Middle Permian. El Nido area, in particular, is rich in stunning limestone karts towers, such as the one under which Ille Cave is settled.
- In the Southern part, over the Busuanga formation, the Caramay schist complex (muscovites, schists, quartzs, micas and graphits) and the Conception phyllites (phyllite mudstones, siltstones, sandstones and met-sediments) form the basement deposits, covering almost the entire area. The metamorphic rocks are considered to come from the Carboniferous and Permian eras (some of the oldest geological materials in the Philippines).

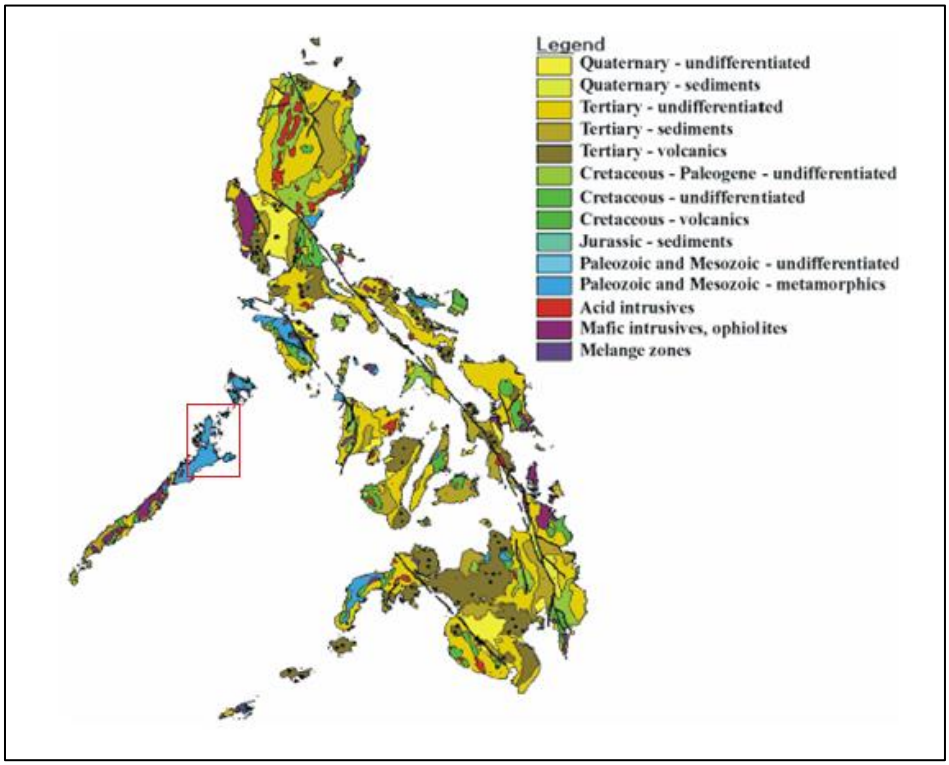


PLATE 2.2. Geological map of the Philippines archipelago (Philippines Bureau of Mines and Geosciences).

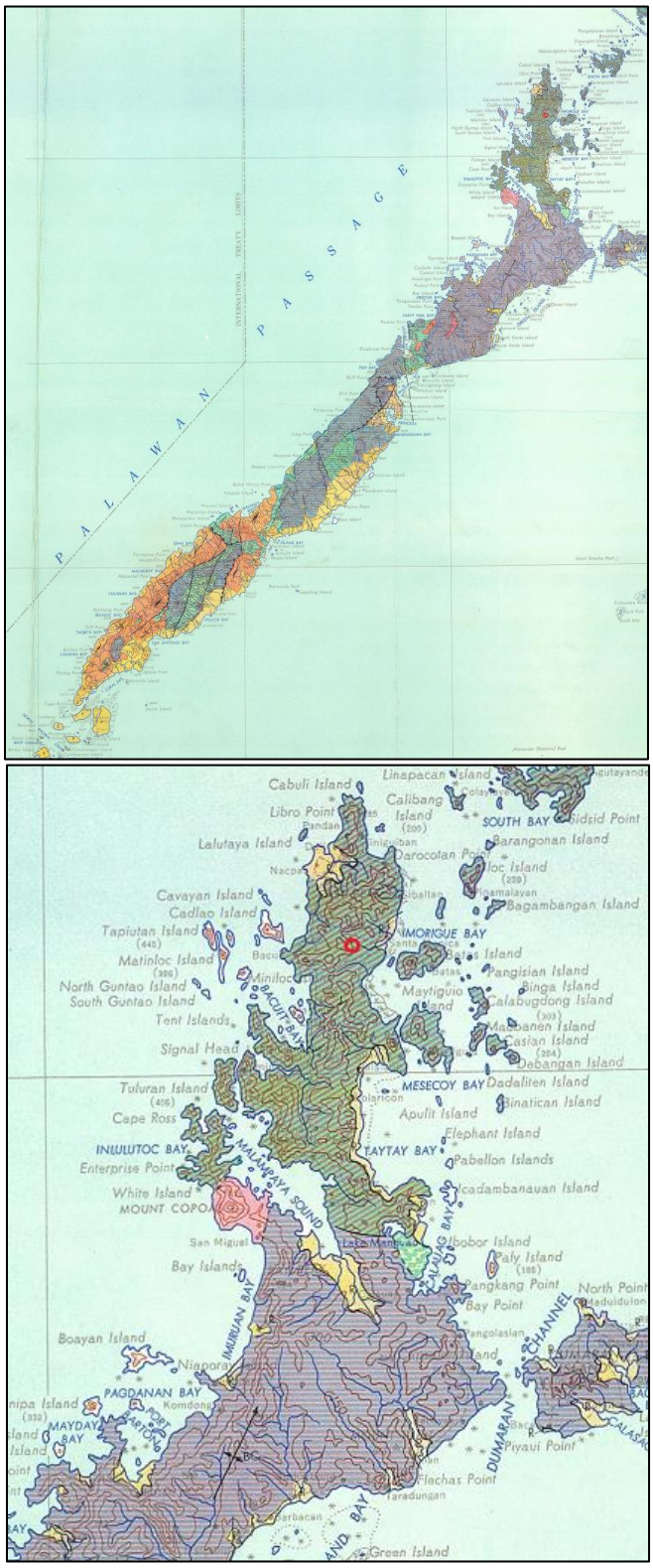


PLATE 2.3. Superior: geological map of Palawan. Inferior: detail of the Northern Palawan area (series 1:1000000 from the Philippines Bureau of Mines and Geosciences).

2.2. THE ARCHAEOLOGICAL SITE OF ILLE CAVE: STRATIGRAPHICAL ANALYSIS, ABSOLUTE DATAS AND MATERIAL CULTURE.

The archaeological site of Ille Cave is located in Barangay New Ibajay, El Nido, Northern Palawan (coordinates: 11 11´ 50´´-11 12´ N, 119 30´ 15´´-119 31´ 20´´ E. The site is in the base of a limestone karts tower (Plate 2.4), in the platform under the rockshelter and both the main entrances to the cavity in the karst (designated as North and West Mouths: Plate 2.5). The karst, of about 75 meters height, is located about 5 km. inland from the closest sea line, the eastern coast of Northern Palawan, at 118 meters above the sea level (PAZ *et al.*, 2013, pp.8-11).

The site has been excavated since its discovery in 1998, and has been part of the Palawan Paleohistoric Research Project which the ASP – UP Diliman has been carrying out since 2004, together with other archaeological sites in Dewil Valley (PAZ *et al.*, 2013, pp.6).

PLATE 2.4. Ille karst tower (Archaeological Studies Program).

As can be observed in the map of Plate 2.6, several trenches have already been opened in the archaeological site of Ille (till season 2013, year in which finish the published literature). The understanding of their spatial distribution is necessary before approach the analysis of the stratigraphical sequence and the main events registered in each trench, which follows.

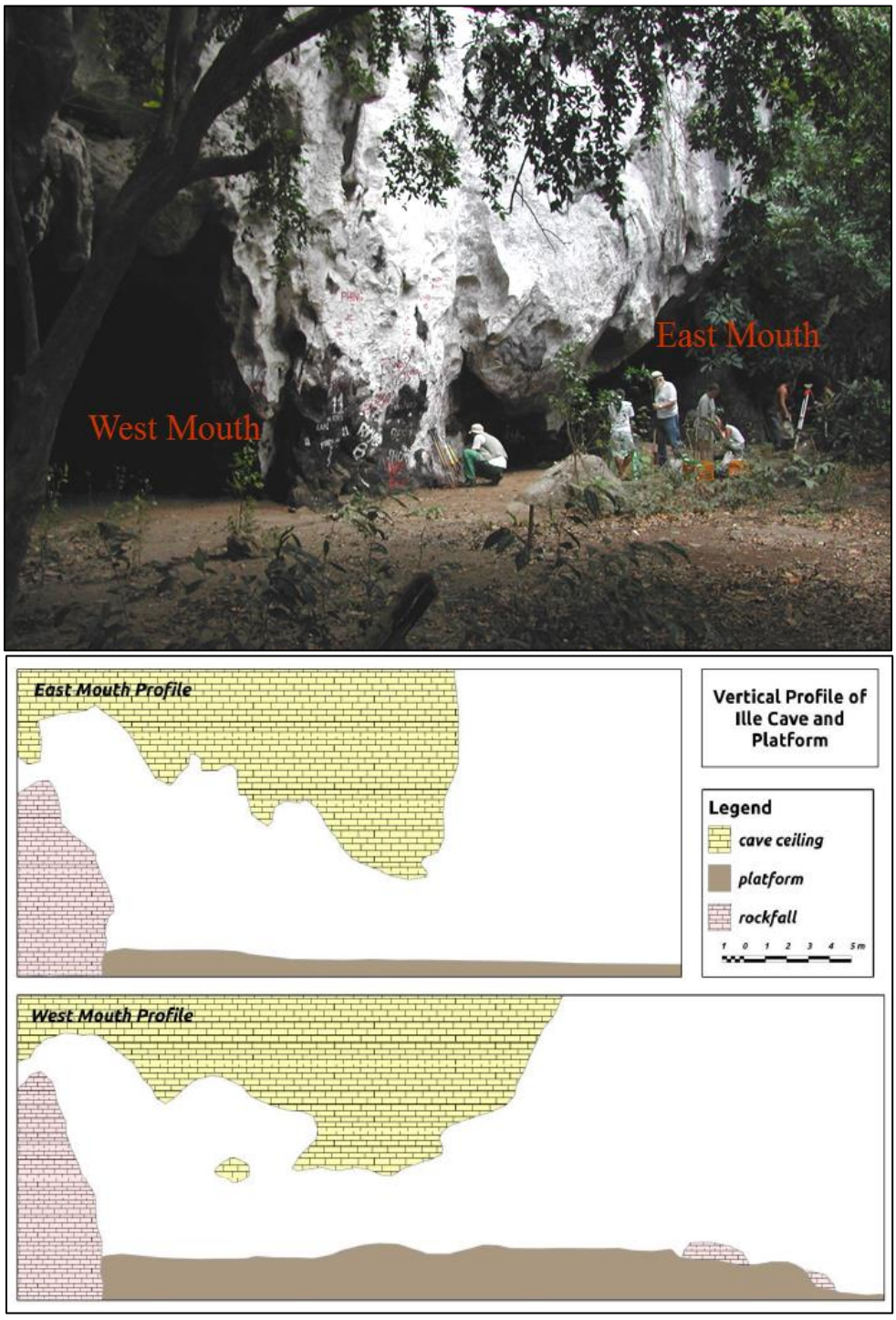


PLATE 2.5. Photography of the base of Ille karst tower, in which both mouths can be appreciated, and vertical profiles of both entrances to the karst cavity (ASP, Emil Robles).

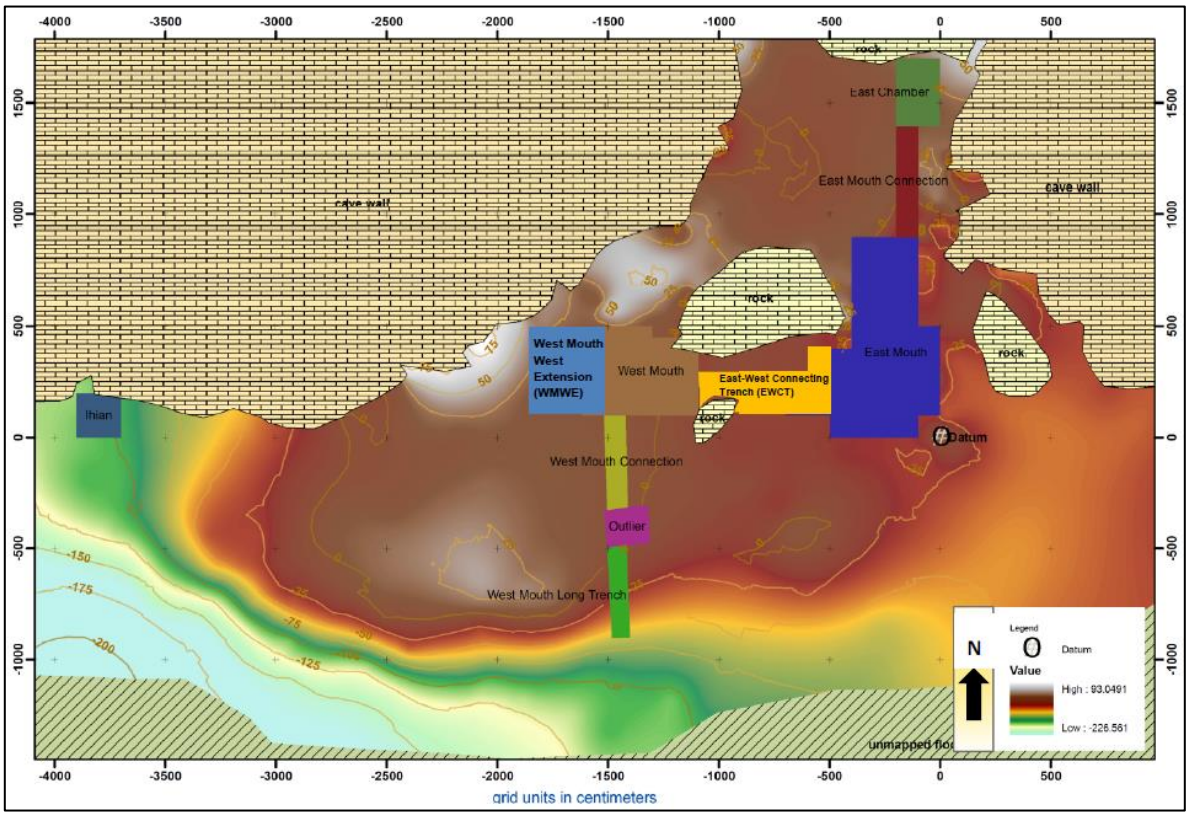


PLATE 2.6. Map of the excavation areas in Ille Cave archaeological site (ASP, Emil Robles).

- **2.2.1. East Mouth trench.**

The origins of this trench, the first one opened by the ASP team in 2004 (together with the West Mouth and the Outlier trenches), are in a previous smaller test pit opened in 1999 and extended in 2002 (when a first group of radiocarbon dating from the upper layers was obtained, pointing to c.10000 BP, what justified the effort of excavating the site), around which posterior treasure hunter digs where reported (PAZ, RONQUILLO, 2004, pp.11). The ASP unified all this preliminary excavations in a bigger trench, which would cover the entrance area of the East mouth of the cavity, over the external platform.

In 2004, the team opened a trench of 4.5x3 meters, cleaned the profiles of the treasure hunter spit and was able to prove the presence of a shell midden layer at around 55 cm. from the surface. Over it, and even cutting it in some cases, the first post-Neolithic inhumations started to appear (PAZ, RONQUILLO, 2004, pp.11), reaching a number of 24 cases, with no signs of grave goods. Mixed in the matrix, also the first signs of material

culture where documented: sherds of earthenware and tradeware (mainly X century China) ceramics, glass beads, stone and shell tools, and even some small metallic rings.

The excavation in the season of 2005 continued exposing the stratigraphy of the site by expanding the sector, in which the same kind of material culture was appearing, and in which another 15 burials where recovered (LEWIS *et al.*, 2006, pp.8-12). Also, this season offered some interesting absolute dates: 7000-9000 BP for the shell midden and 8000-10500 BP for some charcoal samples recovered in the levels under it (so, middle Holocene shell midden and early Holocene *in situ* burning evidences).

One of the highlights of 2005 season was the recovering of the first case of Neolithic burial (LEWIS *et al.*, 2006, pp.18): the context 727, which appeared at 60-80 cm. depth from the datum point. Several grave goods where founded *in situ*, in clear association with the burial: a large *turbo marmoratus* shell close to the left hand, over the chest (possibly was holding it); a pair of manufactured shell disks (*conus sp.*) close to the left forearm, plus another one in the waist; and a group of smaller shell beads and pig tusks underneath the forearm disks. The group located close to the forearm was interpreted as a decorative manufacture made of the shells and the animal bones (Plate 2.7: LEWIS *et al.*, 2006, pp.18-19). Although the burial was recovered over the shell midden levels, is possible that it partially cut them in the feet area.

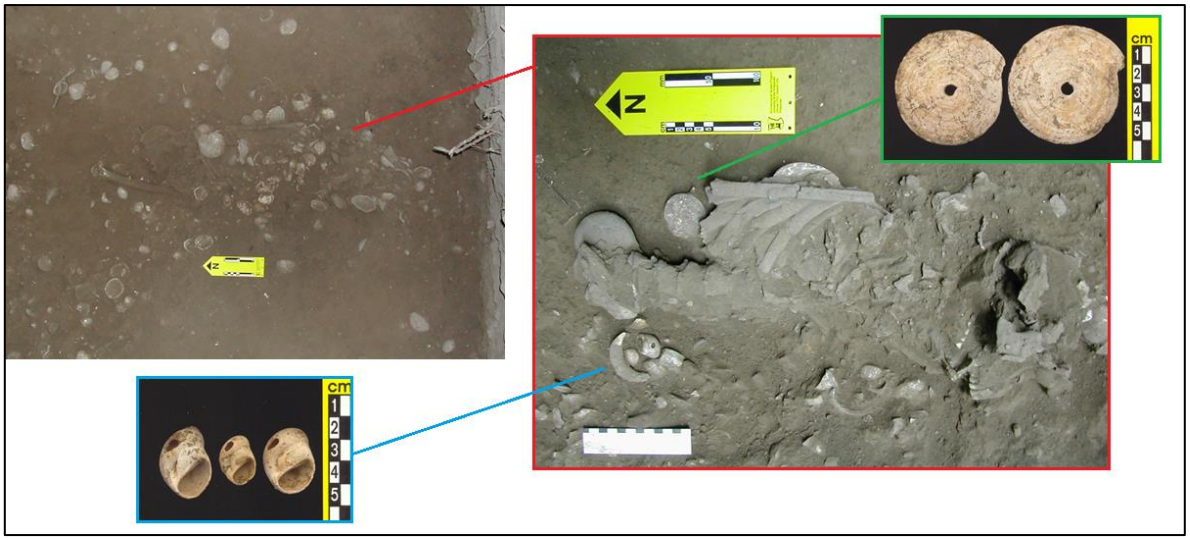


PLATE 2.7. Neolithic burial from Ille Cave East Mouth trench, and detail of the ornamental manufactured shells (ASP).

In the bottom levels excavated in 2005, a new funerary practice was registered for the first time beside the inhumations: the first pre-Neolithic cremation (context 758: Plate 2.8), at 130-148 cm. depth (LEWIS *et al.*, 2006, pp.20). The pile of fragmented and burnt bones overlaid a decayed limestone. Posterior laboratorial analysis where overtaken in this first case of cremation (LARA *et al.*, 2013), suggesting that the body was disarticulated and defleshed, the cranium smashed and some long bones broken, before being burnt in different levels and the remains were recovered and put in a container.

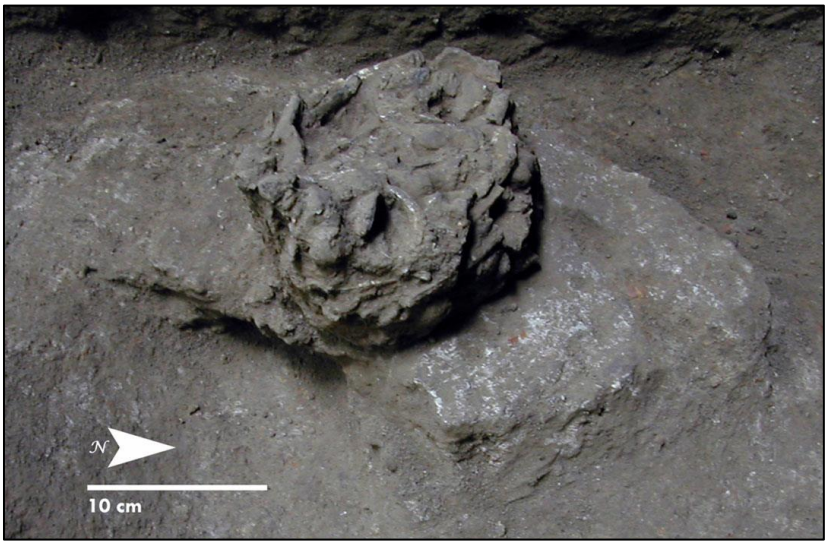


PLATE 2.8. First cremation registered in Ille Cave East Mouth trench (LARA *et al.*, 2013).

Under the cremation (LEWIS *et al.*, 2006, pp.16), some sterile layer was registered (context 806), under which appeared another one (context 866) which included some lithic implements and possible worked animal bones (deer antler). This older phase, unfortunately, couldn´t be dated yet by the end of 2005 season, but it´s study will continue in following years.

In 2006, the team reopened the trench at the same levels. This season was profitable from the perspective of the funerary archaeology in the cremation cemetery phase, since another three cases where recovered from the same levels in which the 2005 cremation was founded (VV.AA., 2007, pp.13). Also, direct radiocarbon dating over bone samples from the cremation and of the sediments around it pointed to a data of approximately 9000 BP. At

around 4.5 meters depth, the excavation continued documenting the sterile levels registered under the cremations since the previous season.

The results of the 2008 excavation season offered another positive result: another two cremations (context 1358, with an obsidian flake associated, and the smaller context 1370) in the same level than the previously four cases reported (PAZ *et al.*, 2008, pp.17-18). Also, the cultural deposits underneath offered a new date which brought the sequence to dates as old as 12000 and 14000 BP.

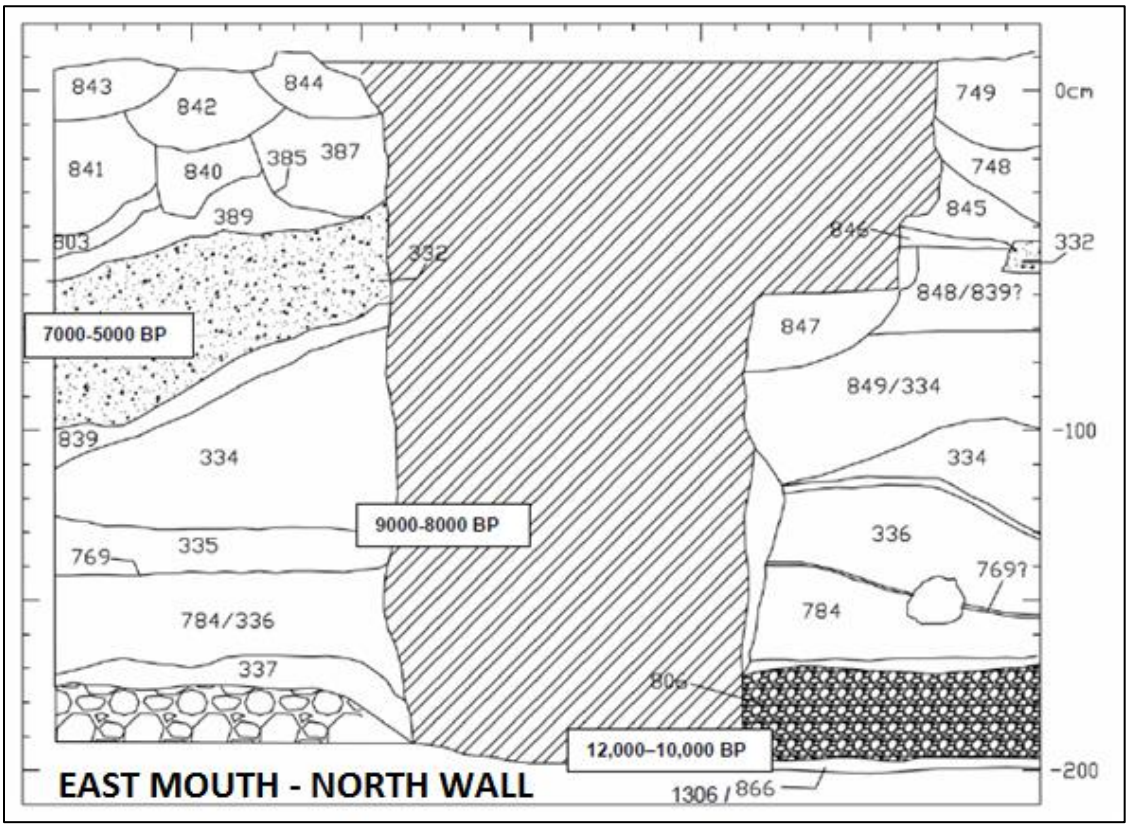


PLATE 2.9. Stratigraphical section of the North wall of the East Mouth trench (ASP).

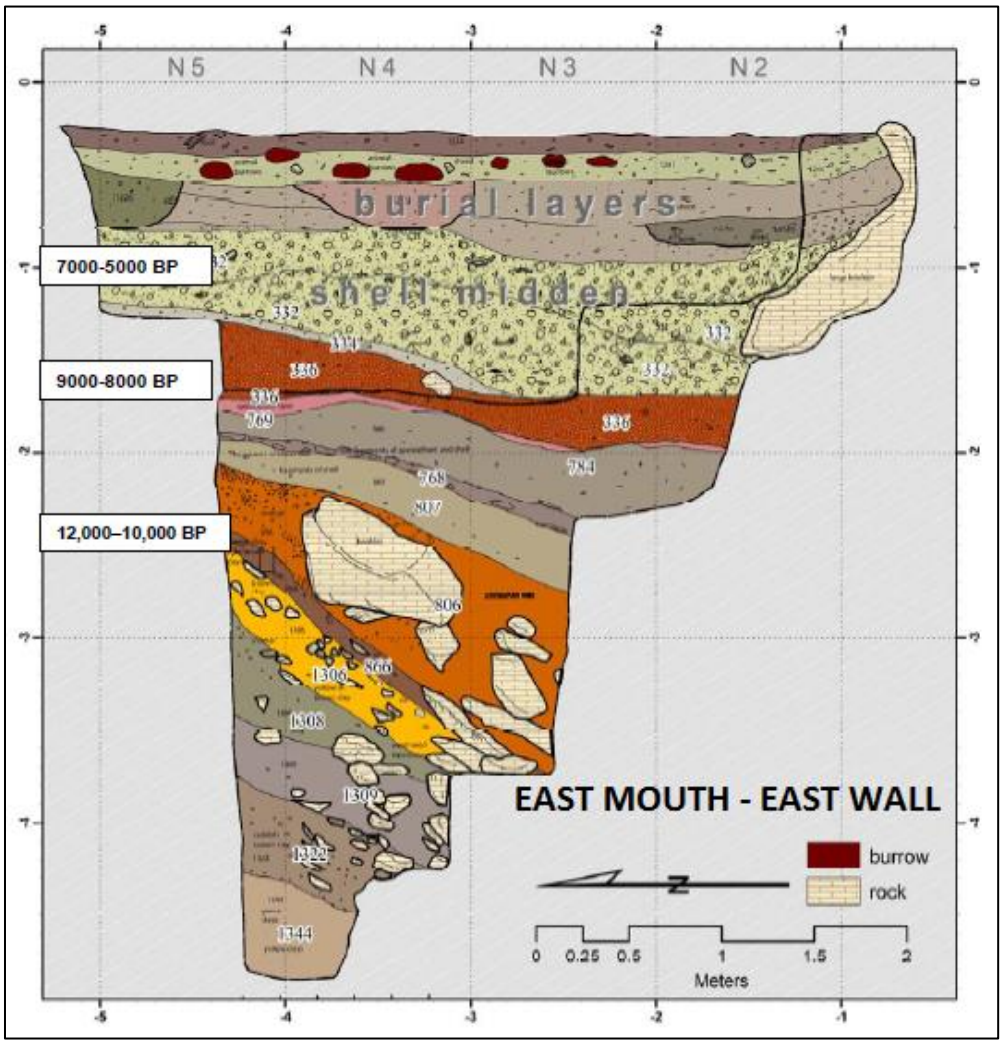


PLATE 2.10. Stratigraphical section of the East wall of the East Mouth trench (ASP).

- **2.2.2. East Chamber trench & East Mouth Connection trench.**

During 2005 season, the ASP direction decided to open a 2x3 meters trench inside the East chamber of the cavity (LEWIS *et al.*, 2006, pp.30-33). An infant burial (context 783) was recovered, as well as similar material culture as the one recovered from other excavation trenches (ceramics and porcelains, faunal remains, *batissa violacea* and *neritidae sp.* shells) and some small shell accumulations which possibly come from the same phase of the shell middens. More accumulations of animal bones where recovered during the 2009 season (PAZ *et al.*, 2009, pp.22).

In 2009, the connection trench with East Mouth trench was inaugurated. In the following year, up to 5 hearths where registered in the same paleosurface (PAZ *et al.*, 2010, pp.19-

20). 2011 was interesting for understanding the depositions of accumulations of animal bones, which where interpreted as the result of a surface flow of water, which dragged the remains inside the cavity (PAZ *et al.*, 2011, pp.25).

In 2012, the data of the deeper archaeological context documented in the East Chamber trench offered a terminal Pleistocene chronology: 10000-12000 BP (PAZ *et al.*, 2012, pp.32). By the end of next year season, 2013, in which the fluvial and colluvial deposits were still been excavated, the trench was closed at the depth of 280 cm. from the datum point (PAZ *et al.*, 2013, pp.29).

- **2.2.3. East-West Connection trench.**

Since 2009, the connection trench between the two main trenches of Ile Cave, the ones of East and West Mouths, was starting to be excavated. In the first year, three post-Neolithic inhumations from the intensive burial phase where recovered, together with big accumulations of tradeware and earthenware ceramics (PAZ *et al.*, 2009, pp.22).

2010 brought in this sector the finding of the 7th cremation documented in Ille (context 2228), together with another inhumation in the upper layers and another *lingling-o* pendant (the third in the site made in *tridacna sp.* shell) which felt down from one of the walls of the trench while cleaning (PAZ *et al.*, 2010, pp.21). Also, a paleosurface with another possible hearth was registered.

In 2012, the excavation in this trench continued, and was possible to document another paleosurface with some possible post holes. Also, the first inhumation in flexed position in the site (context 2240) was recovered (PAZ *et al.*, 2012, pp.41-42). Portions of the shell midden where already being exposed by the end of 2013 season, when the trench was closed at a depth of approximately one meter (PAZ *et al.*, 2013, pp.30).

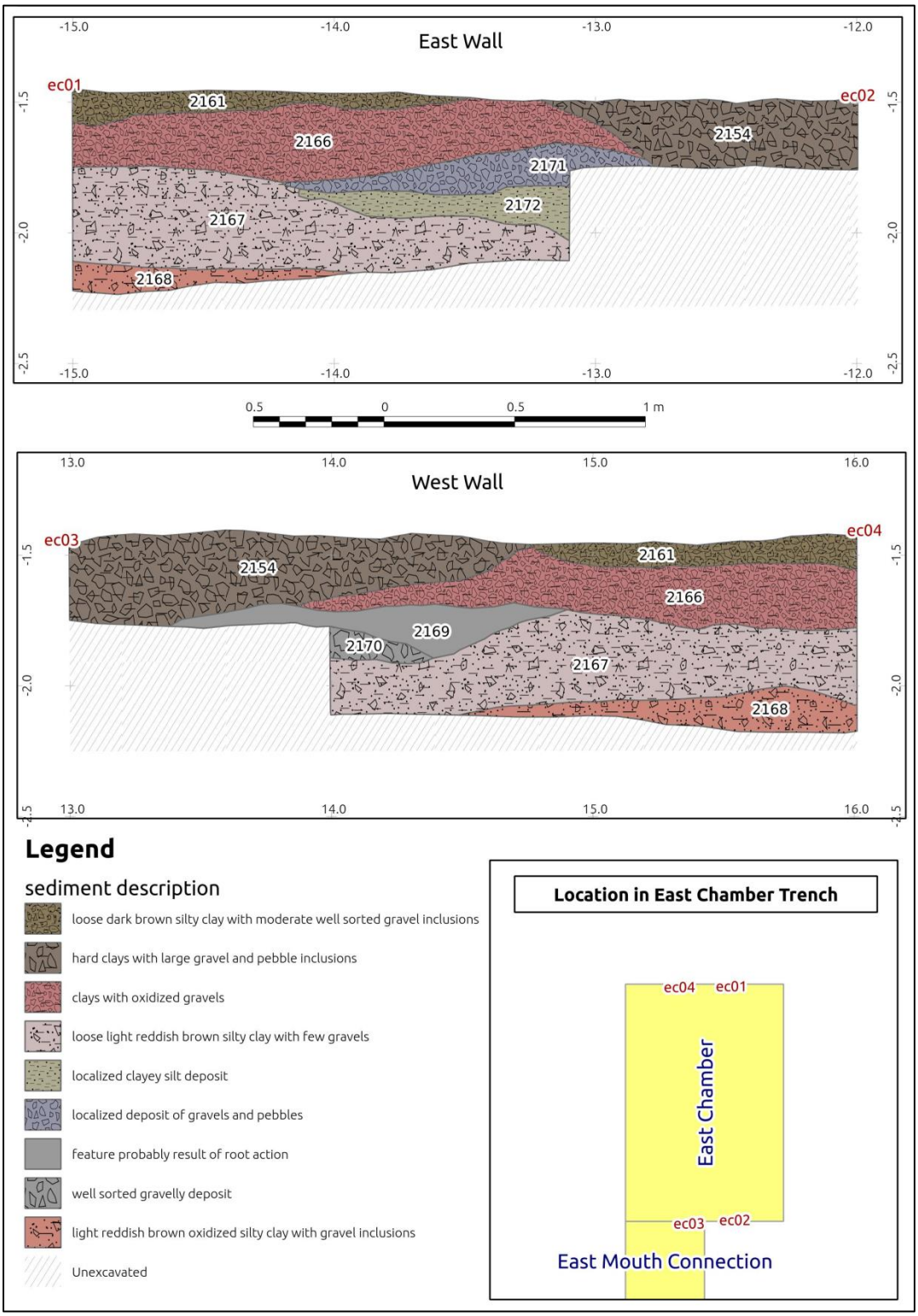


PLATE 2.11. Stratigraphical sections of the East Chamber trench (ASP, Emil Robles).

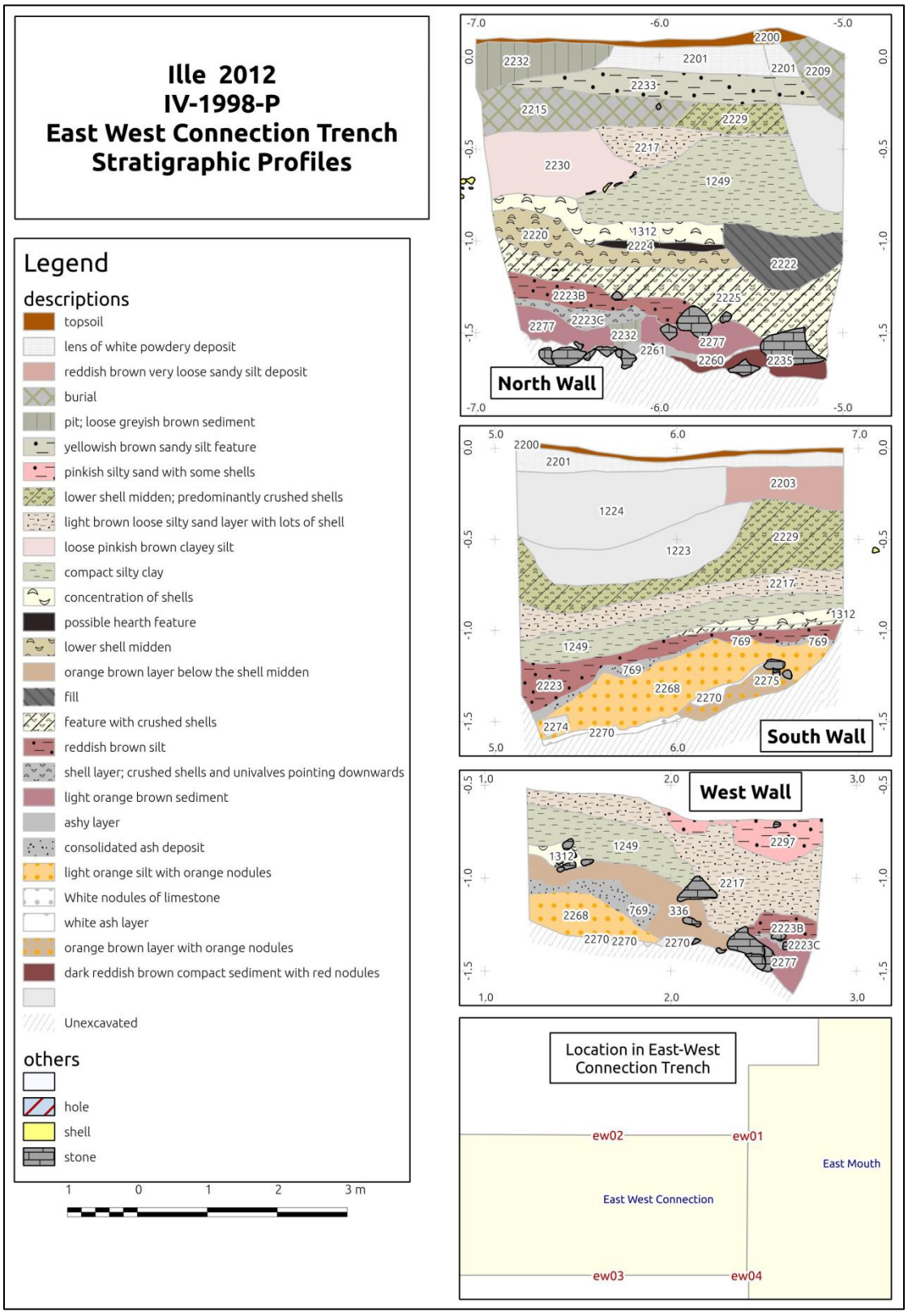


PLATE 2.12. Stratigraphical sections of the East-West Connection trench (ASP, Emil Robles).

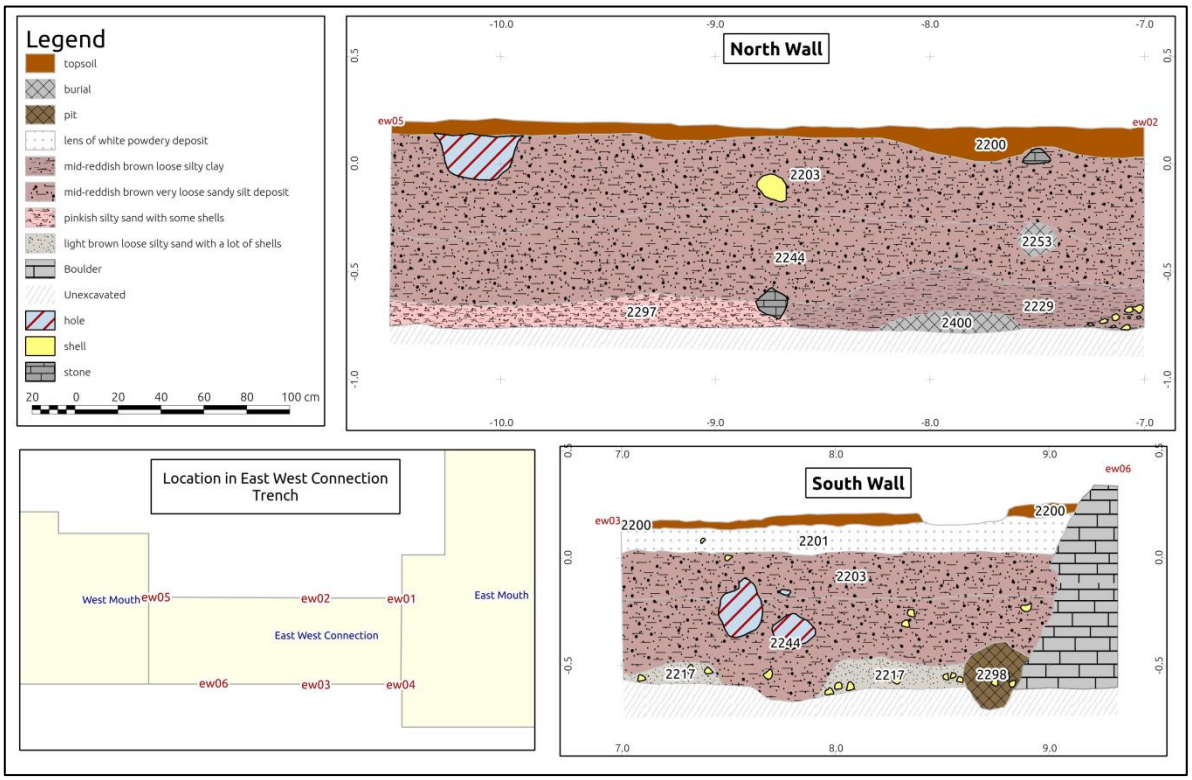


PLATE 2.13. Stratigraphical sections of the East-West Connection trench (ASP, Emil Robles).

- **2.2.4. West Mouth trench.**

The systematic excavation carried out from the ASP started in 2004, extending over some previous test pits, opened in the platform in front of the West mouth of the cave. The excavated area, of around 3.5x2.5 meters, arrived to a depth of 2.3 meters from the datum point by the end of this first season, in which post-Neolithic levels where documented. The main events registered in the stratigraphy where some burials of the upper layers (total of 8, counting the ones from the previous test pits, without grave goods: Plate 2.14), a rock fall (at which level the previous year test pits stopped) and the first cases of hearths documented in the site (PAZ, RONQUILLO, 2004, pp.12). About the material culture, mixed with the fills of the burials, where recovered different materials: shells (highlighting some fragments of *tridacna sp.*), pottery sherds (native and imported) and numerous glass and shell beads (including *lingling-o* and a piece of a shell bracelet).

PLATE 2.14. Some examples of the post-Neolithic cemetery burials (inhumations). The absence of grave goods in this phase can be appreciated (ASP).

The post-Neolithic cemetery continued been excavated during the 2005-2006 seasons (LEWIS *et al.*, 2006, pp.21-30), in which the presence of *batissa violacea* shells was noticed in the layers, although not in clear association with the inhumations. Some metallic implements (mainly copper implements in 2006, iron fractured blades and some punctual cases of gold rings in 2006) were also documented. About the ceramics, the recovery of several fragments of big jars (Sa Huynh-Kalanay type), normally used for jar burials, complicated the interpretation of the site. Nowadays there are still no proves of a jar burial cemetery in Ille Cave, although it exist the possibility that where surface votive offerings that got fragmented and mixed with the backfill sediment of the burials (LEWIS *et al.*, 2006, pp.24). Also, under the burial layers, ceramic materials continued appearing (now ascribed to Neolithic typologies), as well as faunal remains and lithic implements. But the highlight discovery of these seasons was the intentional burial of a dog, an interesting marker of animal domestication (LEWIS *et al.*, 2006, pp.26).

PLATE 2.15. Dog burial documented in the West Mouth trench (ASP).

The main even recovered from the West Mouth trench in 2007 season (VV.AA., 2007, pp.13) was the context 1626: a big amount of mammalian bones and shells where founded together with stone tools. Together with it was observed the presence of a level of aceramic shell midden, underlying the upper one (Plate 2.17). Also, another special inhumation (context 874) was recovered under a stone marker (which the directors of the excavation interpreted as a "boat-shaped marker": PAZ, 2012, pp.144), covered by red pigment and which had two big *melo sp.* shells on the right chest and a necklace of *conus sp.* and monkey teeth (Plate 2.18).

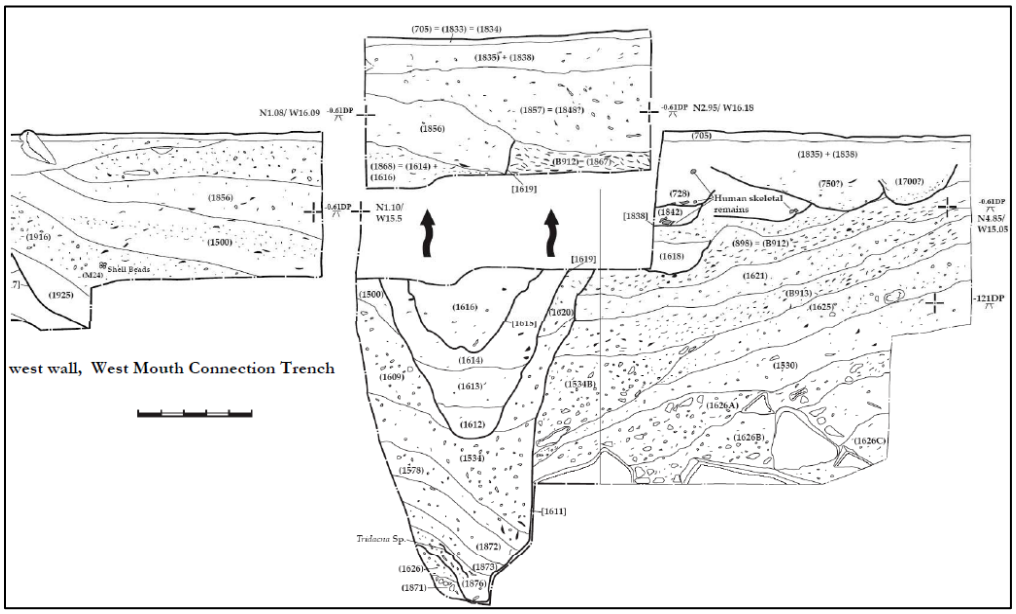


PLATE 2.16. Stratigraphical section of the West Mouth trench (ASP).

PLATE 2.17. Stratigraphical section of the West Mouth trench in which both levels of the Middle Holocene shell middens (the ceramic in orange and the aceramic in yellow) can be appreciated (ASP).

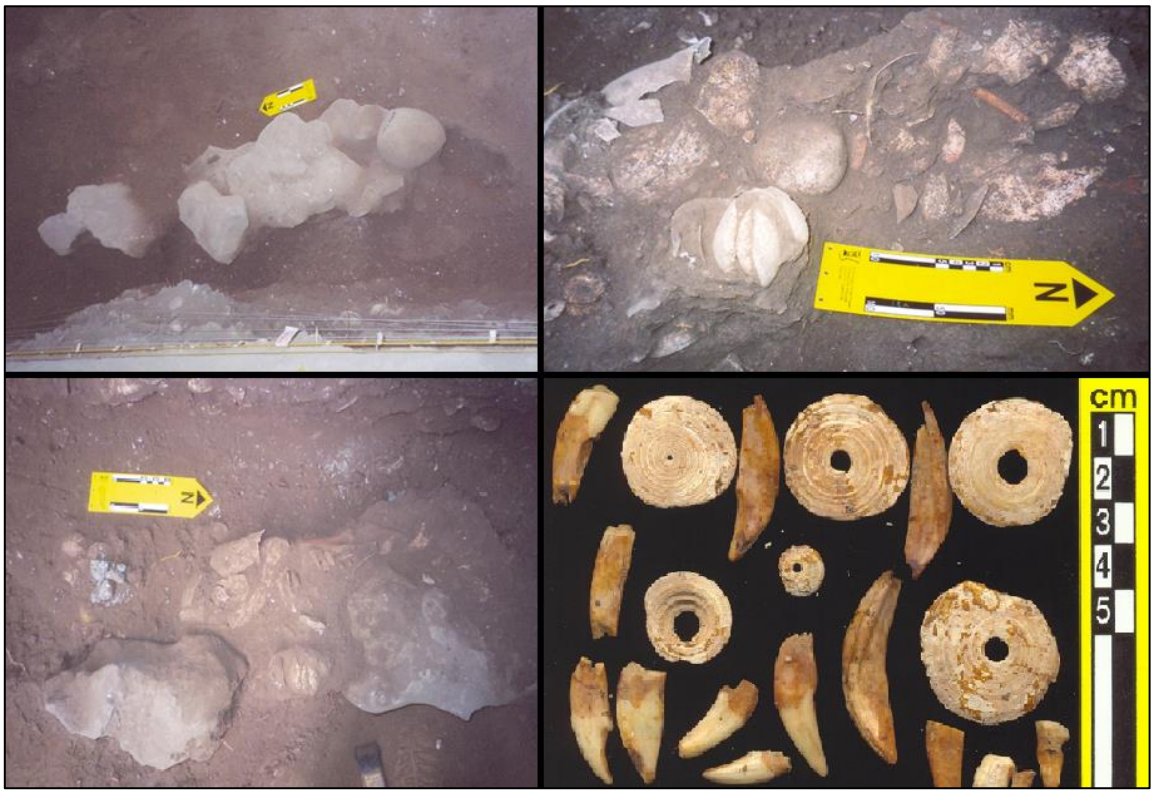


PLATE 2.18. Burial under the "boat-shaper marker" documented in the West Mouth and detail of some of its grave goods (ASP).

- **2.2.5. West Mouth Connection trench.**

Opened for the first time in 2007, for connecting the West Mouth and the Outlier trenches. As expected, several human remains where recovered also in the upper layers of the stratigraphy, as part of the post-Neolithic inhumation cemetery (VV.AA., 2007, pp.13). The trench, of 1x4 meters, arrived at 120 cm. depth at the end of its first excavation season without any other particular finding, furthermore the materials observed in the main trenches for this phase.

- **2.2.6. West Mouth West Extension trench.**

Opened in 2008 for avoiding the collapse of the West Mouth trench. During this season, the stratigraphy followed the organization of the West Mouth: upper layers which mixed different materials (where the first *lingling-o* made on green mica was recovered, together with the typical materials ascribed for this period shown in other trenches) with some post-Neolithic inhumations and the starting of the shell midden layers, where the excavation stopped (PAZ *et al.*, 2008, pp.15-16). During the next seasons, similar burials and materials where registered in the deeper layers (PAZ *et al.*, 2012, pp.46). By the close of 2013 campaign, the depth of the trench was in 62-77 cm. from the datum point (PAZ *et al.*, 2013, pp.27).

- **2.2.7. Outlier trench.**

The third trench opened in the first systematic excavation season (ASP, 2004), further away of the rock shelter, in order to try to avoid the intensive burial activity for digging faster and discovering what would laid under (PAZ, RONQUILLO, 2004, pp.12-13). The trench, of 2x2 meters, reached a depth of around 125 cm. Up to three post-Neolithic burials where discovered at around 60 cm. depths, one of them (context 69/77) specially interesting because of preserving some Indo-Pacific beads *in situ*. At the depth of almost a meter, an accumulation of pig bones where founded under a rock, presumably covered with hematite. Tradeware and earthenware ceramic sherds where founded in all the archaeological levels, which corresponded with the ones documented in the West Mouth trench.

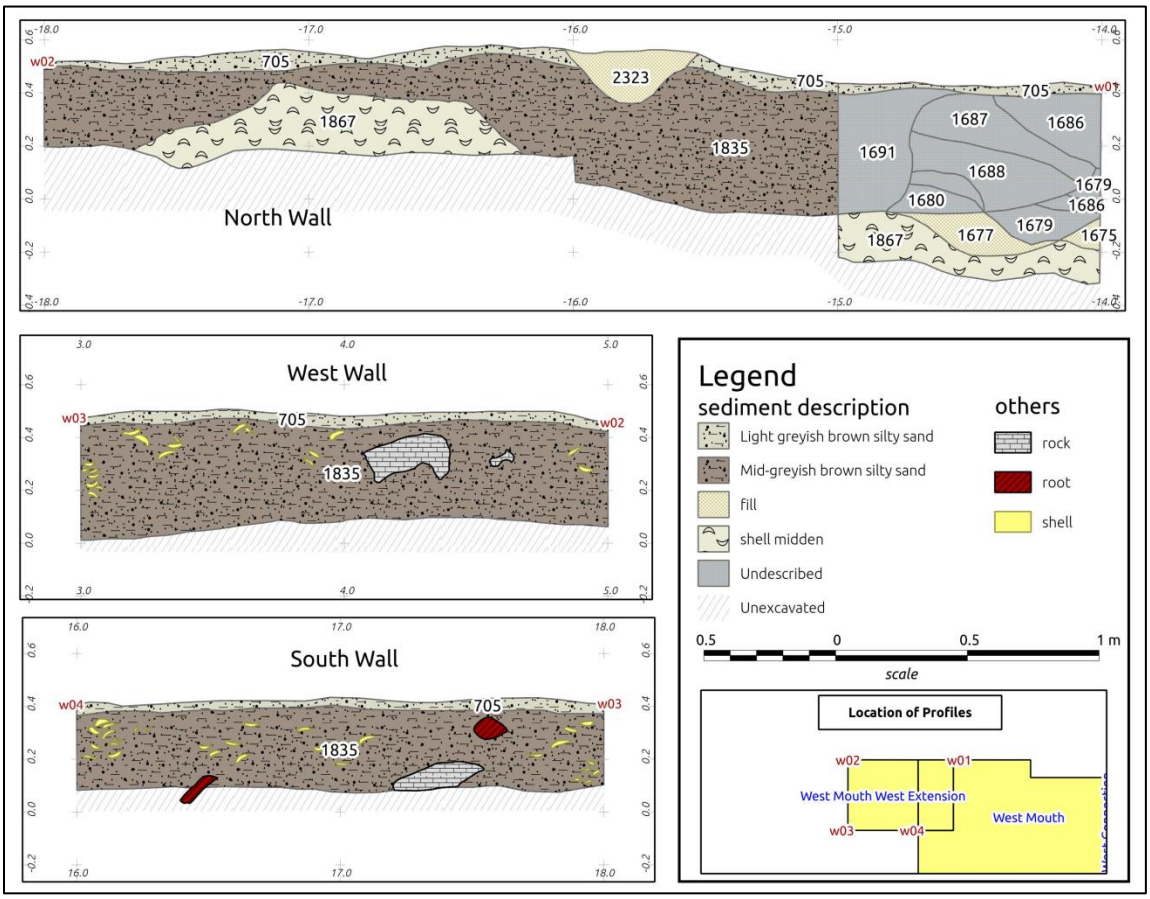


PLATE 2.19. Stratigraphy of the West Mouth West Extension (WMWE) trench (ASP, Emil Robles).

In 2009 (2009, pp.23) this trench was opened again, and excavated till a depth of 2 meters, revealing new burials of the same phase (Metal Ages and Contact phase).

- **2.2.8. West Mouth Long trench.**

Opened in 2007, with the idea of a better understanding of the geology of the platform. A copper axe was founded at 30 cm. depth, but no burial was recorded, until the recovery of an individual inhumation in 2009 (PAZ *et al.*, 2009, pp.23-24).

- **2.2.9. Iihan trench.**

Open for the first time in 2006. During this first season and the following, 2007 (which closed the trench in a depth of 160 cm.), a shell midden with pottery sherds and a stone adze where documented in this trench, together with a bifacial stone tool recovered from the surface in a close location (VV.AA., 2007, pp.13).

2.3. THE CHRONO-CULTURAL SEQUENCE OF ILLE CAVE.

Thanks to the study of the stratigraphy registered in the several open trenches in the site of Ille Cave, the chrono-cultural sequence of phases has been defined as follows (PAZ *et al.*, 2009, pp.41-43):

A. **Current phase (Late XIX century – Present).** Remains of the ancestors of the current inhabitants of El Nido for the last c.100 years. Agricultural-based cultures (cereal). XX century material culture.
B. **Ritual intensification phase (c.2000 years ago - late XIX century).** Presence of burials (Neolithic-Contact phase). Funerary practice: inhumations, oriented to SW, no grave goods associated. Possible secondary burials associated with jars (first earthenware, latter tradeware ceramics -evidence of contact with mainland Asia-), not buried but deposited in the cavity. Possibly the different rituals correspond to different cultures and timing.
C. **Dominantly habitation phase (c.6000-c.2000 years ago).** Middle Holocene shell middens and hearth deposits (which include remains of food consumed) justify the use of the place as a campsite, or perhaps more permanent habitation area. Funerary practice: inhumations, oriented to NE, associated grave goods (hammer stones and shells -manufactured or not-). Possible secondary burials, ossuaries.
D. **Non-pottery habitation phase (c.8000-c.6000 years ago).** Shell middens which justify the habitation. No signs of ceramic technology, but strong presence of shell utilization. Possibly the boat-marked burial belongs to this phase.
E. **Habitation and cremation cemetery phase (c.10000-c.8000 years ago).** Funerary practice: cremations. Presence of animal remains, not yet domesticated. Signs of a different landscape that the one shown in earlier phases: remains of tiger, deer, estuarine shells (dryer and more open, not so much vegetation, grass extensions).
F. **Campsite phase (c.12000-c.10000 years ago).** First lithic implements, signs of technology.

The following Chart 2.1 shows a summary of this ritual and economic characterizations for every cultural phase of the sequence.

Chart 2.1. SEQUENCE OF CULTURAL DEPOSITION IN ILLE CAVE (as in PAZ *et al.*, 2009).

**"X" = registered, "-" = not registered.*

PHASE	CHRONOLOGY	HABITAT		TECHNOLOGY			FUNERARY CONTEXTS				FAUNA	LAND-SCAPE
		Shell middens	Hearth deposits	Cera-mics	Shells	Lithics	Ritual	Orien-tation	Grave goods	2^{DARY} burials		
A: Current	Late XIX century - Present	XX Century material culture (ceral agricultural-based economy)										Humid, covered by forests
B: Ritual intensifica-tion	c.2000 years ago - late XIX century	-	-	X	X	X	Inhuma-tions	SW	-	Surface jars?	Domestic + Wild	
C: Dominantly habitation	c.6000-c.2000 years ago	X	X	X	X	X	Inhuma-tions	NE	X	Ossua-ries?	Domestic + Wild	
D: Non-pottery habitation	c.8000-c.6000 years ago	X	-	-	X	X	Inhuma-tions	NE	X	-	Domestic + Wild	
E: Habitat and cremation	c.10000-c.8000 years ago	X	-	-	X	X	Crema-tions	-	-	-	Wild	Open grass extensions, dryier than latter
F: Campsite	c.12000-c.10000 years ago	X	-	-	-	X	-	-	-	-	Wild	

3. METHODS OF LABORATORIAL ANALYSIS IN HUMAN OSTEOLOGY.

3.1. THE INVENTORY OF HUMAN REMAINS AND THE FINAL STUDY ASSEMBLAGE. MINIMAL NUMBER OF INDIVIDUALS (MNI).

Before we began the study of the human remains of Ille Cave, it was necessary to define which part of the extensive collection of skeletons should focus the analysis. The initial idea was to study the prehistoric populations of Ille after the earlier burials, as introduced in the Chapter 1 – Chart 1.1 (including these first cases). This would immediately exclude two groups of funerary contexts clearly represented in the stratigraphy:

- The cremation cemetery (7 cases, lower levels of stratigraphy): made sense to omit in our study, since other investigators from ASP focused their analysis on them (LARA *et al.*, 2013).
- The phase of burials of colonial times (higher levels, part of the phase of intensive burials): was omitted here because the aim of this study is to analyze the populations previous to the Spanish contact phase.

In order to omit this cases, the official ASP-UP Diliman inventory of human remains from the site was used as a primary source, which has been developing and changing in recent years by the team of archaeologists from Palawan, and which consultation was provided to us from the ASP itself. The inventory consists of a list of archaeological contexts including human bones, as well as detailed information about the anatomical parts represented and initial results of sexing and age determination in some individuals (although our work included both aspects as part of the process of our own analysis approach).

The case of the discard of the colonial individuals was somehow more complex: the stratigraphy of the upper levels of Ille Cave, as we saw in the previous chapter, offers considerable interpretative problems, given the chaotic organization of the strata due to intense funerary activity for a long period of time and the lack of absolute chronologies

from skeletal contexts. Current understanding of the phasing derives from the interpretation of the various archaeological materials, as well as the composition of documented strata and their stratigraphic relationships, leading to a process of relative dating (for example: comparative chronologies with what we have before or after inside this sequence).

In that sense, the assistance of Dr. Helen Lewis, co-director of the archaeological site of Ille Cave, was essential. Responsible for preparing the complex Harris Matrix, Dr. Lewis knows better than anyone the stratigraphy of Ille, and was able to isolate a number of individuals who definitely belonged to what is referred as the colonial phase. Thanks to that list of individuals we solve, at least partially, the problems of chronocultural definition of our study.

Beyond this, our study sought to focus attention on adult individuals, since other specialists in the ASP are currently working on non-adult remains. Therefore, and based on the information in the inventory and Harris Matrix, the group of non-adults was also omitted.

In the table below, we can see all individuals omitted in the study (Chart3.1), as well as the reason for the dismissal:

Chart 3.1. LIST OF INDIVIDUALS FROM ILLE CAVE INITIALLY OMITTED FROM THE STUDY (CHRONOLOGICAL AND AGE REASONS).

**Subadult individuals omitted from our study (based just in adult individuals).*
***Also omitted individuals from colonial period and cremation cemetery.*

CONTEXT Nº.	SUBADULT	COLONIAL	CREMATION
55		X	
79/708	X		
120/2266	X		
226		X	
352/353		X	
489		X	
702		X	
704		X	
707	X		
710		X	
711		X	
713		X	
714/715		X	
719/720/1214?/2209?		X	
722/1237?	X		
723		X	
724		X	

CONTEXT Nº.	SUBADULT	COLONIAL	CREMATION
735	X		
738		X	
742/744		X	
748		X	
749/1225		X	
751		X	
753	X		
754		X	
756		X	
757	X	X	
758			X
762	X	X	
765	X		
767	X	X	
779	X		
787	X		
914		X	
918		X	
924/1243?/1404?		X	
928		X	
931		X	
934		X	
937		X	
951		X	
1215/1216	X		
1230		X	
1231		X	
1233		X	
1239		X	
1244	X		
1246		X	
1247/2212?		X	
1250		X	
1324			X
1325			X
1327			X
1330/1332	X		
1333/1356	X	X	
1334/1355	X		
1338			X
1358			X
1364	X		
1801		X	
1805		X	
1807	X	X	
1808		X	
1814/1815		X	
1842/1848/1853?		X	
1924		X	
1929		X	
2205	X	X	
2210		X	
2228			X

CONTEXT Nº.	SUBADULT	COLONIAL	CREMATION
2246		X	
2249	X		
2255	X	X	
2263	X	X	
2320		X	
2324		X	
2325		X	
2326		X	
2327		X	
2365	X	X	
2367		X	
2382		X	
2400		X	
2503	X	X	

The comparison between this table of discarded cases and the contexts recorded in the inventory of the ASP offer us the list of skeletons to study, knowing certainty that they would come from the central phase of the stratigraphy. It was hard to define which of them all exactly belong to the prehistoric or pre-colonial phase, and which of them would come from a transition phase to the new cultural and economic models. The analysis of associated materials doesn´t gave us too much information, as many skeletons didn´t appear directly associated with material culture, but *a priori* the premise showed valid until a better definition of the cultural sequence of Ille Cave.

In any case, the MNI (minimum number of individuals) represented in this assemblage selected for the study is 20: it coincides with the number of contexts selected, since was noticed that every craft associated to each context contented the human remains of a separate individual, without any bone which could point to the presence of more individuals mixed in the assemblage (in this sense the human remains where well organized in the ASP before the start of the project).

3.2. STARTING LABORATORIAL PROCEEDINGS. CLEANUP OF HUMAN REMAINS.

The laboratory work procedure was also systematized in a series of steps we would take out on each of the contexts we wanted to study, and that can be summarized in the following points:

1. Location of context to study at the human remains archive ("Palawan room") and manual transport to the laboratory.
2. Careful unpacking of the human remains on the work table.
3. Lying out of skeletal remains in anatomical position.
4. Cleaning of human remains (if necessary).
5. Inventory of the bones present in each individual, as well as comments on conservation status, and collection of data in the corresponding file.
6. General photography of the skeleton in anatomical position.
7. Determination of gender and age by various methods (*vide infra*: 3.4 and 3.5) and data collection of the results in another specific file model.
8. Macroscopic analysis of surfaces looking for the various pathologies present in the individual and its justification by differential diagnosis, as well as data collection in a separated file.
9. If necessary, microscopic or X-ray approach to certain bones which possibly would require a more specific analysis in order to define the differential diagnosis.
10. Photography of observed pathological lesions.
11. Careful packaging of human remains and transfer back to the store of human remains.

In the case of the packaging system of human remains, mention here that the ASP follows a specific system: numbered boxes organized by context within which the human remains are packaged in sets of bones that represent the various anatomical sections (skull, torso, pelvic girdle, shoulders, arms, hands, legs and feet), showing a specific label in each bag that contains elements. The bones are organized inside the box, as far as possible, through a system that ensures that groups of heavier bones occupy the bottom of the box, so that the most delicate remain above and do not support excessive weights which could lead to damage. The ASP human osteology laboratory follows procedures in packing skeletons as recommended by Barc, University of Bradford (Plate 3.1).

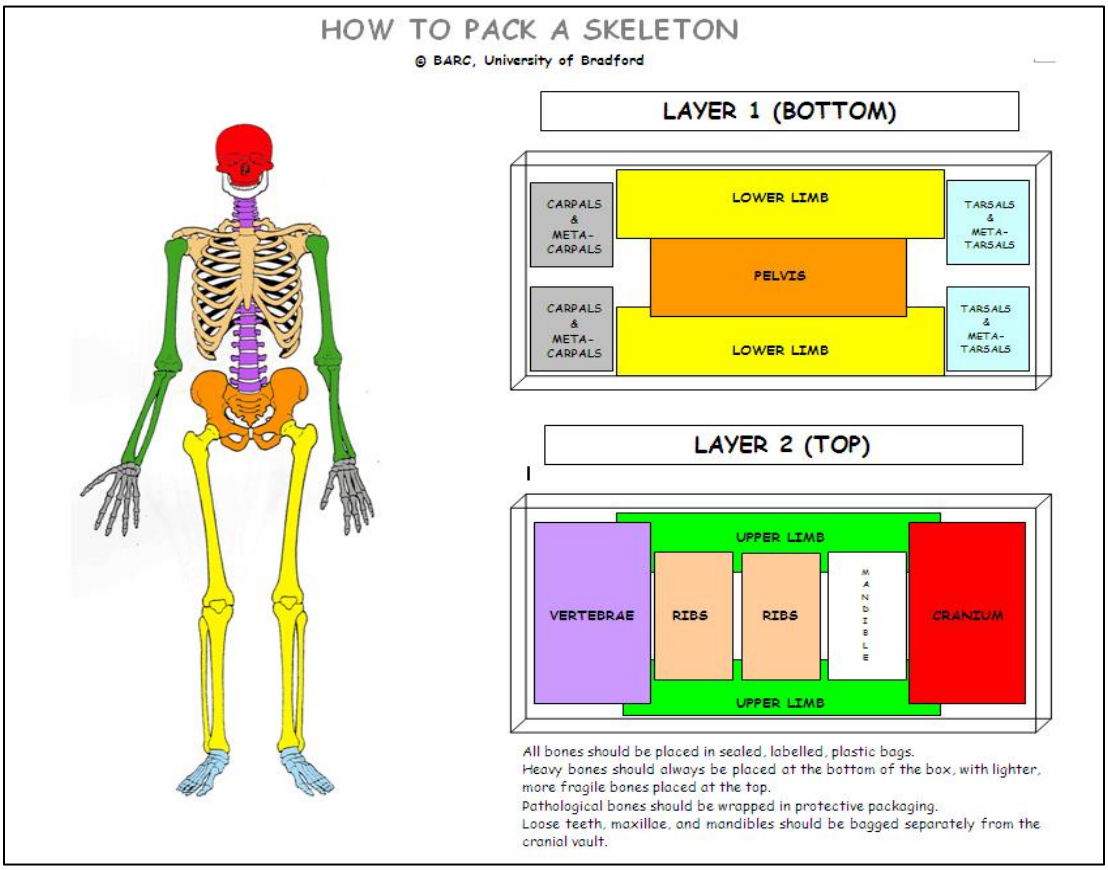


PLATE 3.1. Diagram which displays the correct way of packing skeletal remains. We can appreciate the fact that the most heavy groups should be concentrated in the bottom of the craft, in order to preserve better the lighter ones in the top (From: University of Bradford, UK).

The work space also required specific preparation and constant maintenance and cleaning. Since the space provided in the laboratory of osteology had a hard, rigid surface (tiles), a double layer to lay the bones, consisting of two materials was prepared: a first layer of bubble wrap, to cushion contact of the bones with the hard surface, and a second surface layer of cardboard of a coloration that was not present in the human remains (a blue tint that would standardize the surface while facilitating the process of photo shoot).

The lay of human remains in anatomical position was made following the traditional model in extended supine position (Plate 3.2), with legs and feet parallel in top view, arms also parallel to the torso and hands facing up. In case of missing skeletal parts, was tried to maintain anatomical spaces, to facilitate a better understanding of the skeleton and more effective photographic record.

PLATE 3.2. Individual 2247 from Ille Cave, displayed over the work space in anatomical position.

Sometimes the cleaning of human remains was necessary to facilitate their study (Plate 3.3): when requested, a dry cleaning of the bones was carried out, using soft bristled brush or wooden sticks, with several repetitions but without making excessive force that could affect the samples. In very specific cases, where the sediment adhering to the bones could not be easily removed, "wet" cleaning was the best option: in this case the bone surface was never directly wet (much less placed under water directly), but the bristles of the brush slightly moistened prior to brushing the samples.

As can be deduced from the work plan above, restoration work was not carried out (any consolidation or glue process, because we wanted to avoid chemical affection on the bone structure). Unfortunately was not possible to make any kind of cleaning of the profuse concretions which were affecting several of different bone surfaces, since this procedure requires the use of chemicals (such as dilute acetic acid) which were not available.

PLATE 3.3. Photographic sequence taken during the process of bone cleaning: dry cleaning with wood stick (left and central images) and wet cleaning with brush (right).

3.3. INVENTORY, PHOTOGRAPHY AND PRELIMINARY MACROSCOPICAL ANALYSIS.

Once the complete skeleton had this initial treatment outlined above (section 3.2), it was time to start recording it. For that was made a first specific file of data collection relating to the inventory, organized in anatomical sections, including all the bones present in each individual (also dental pieces, annotated by the FMI international system). Also was performed a briefly outlining about their level of fragmentation and which parts of each bone were present or not (*vid infra*: 3.7 and Annex I).

In parallel, and continuously during the rest of the process of data collection over the human remains, was initiated at this time a phase of photographic work, for the preparation of the corresponding photographical archive, which would serve to illustrate both this paper and the files catalog itself, and that at the same time would serve as visual justification of the various interpretations given to the human remains.

The photographs were taken with a reflex camera: model Canon EOS 600DTM, with 58mm objective. At no time tripod or support element was used either for lack of availability or practical reasons, given the conditions of the workspace (as can be observed in Plate 3.4).

Two complementary photographic series can be distinguished, for which external conditions change significantly:

- Main series: this is the serial used to capture from the vertical the complete skeleton in anatomical position (which would associate the inventory of individual bones), using both adjustment and automatic focus. Blue background was used to clearly mark the boundaries of the image. In addition, each individual would be accompanied by a chart with the number of context to which it belongs, as well as a metric scale (an IFRAO scale was used because, besides marking ten centimeters and being more visible in the final picture, it adds additional information about color that could be of interest). The photographs were pulled from the vertical, orthogonal to the plane surface and without the use of flash, but serving the artificial lights of the own laboratory and auxiliary lights in some specific cases. In some cases the height of the laboratory is not high enough to capture the entire extended skeleton: in these cases two separate pictures were taken, with an area of overlap of at least 30%, so that a photogrammetric composition could be made with both the shots, corrected by using Photoshop™.
- Macro/details series: in this case the macro mode is used with manual focusing and adjustment, and again on blue background, but with a smaller metric scale (5 centimeters). In some cases it was not possible to include images scale due to the difficult positioning in the working plane of skeletal remains which were too fragile, but the necessary measurements could be obtained from general pictures. We shoot the photos as orthogonally as possible in the case of general views of whole bones, while in the case of photographs of detail this standard became secondary, intending to best reflect the areas of interest. In this series the use of additional artificial lights became a mandatory part of the process, in order to bring out details by the use of light.

PLATE 3.4. For the photographical register The use of artificial auxiliary lights, a uniformed color background and different measurement scales was also recurrent, in order to present as much information as possible in each series (right).

3.4. SEX DETERMINATION.

In reference to the sex determination of the individuals, a number of methods are employed, based in physiological aspects or skeletal landmarks that vary in men and women between populations. In the Plate 3.5, for example, we can see the case of the skull in men and women: in general terms, the male is larger and heavier, with more apparent muscle attachments, further development of the occipital prominence and mastoid (in the supramastoid, female is more curved ridge and ends on the acoustic meatus) and the supraorbital ridge, causing a rounded supraorbital margin (FLANDER, 1978).

The elements showing the sexual dimorphism become especially visible in the skull and pelvic girdle, so analyzing the morphology of both will be relatively easy to determine the sex of the individual to which they belong (BUIKSTRA, UBELAKER, 1994). To do this, analysis over a series of landmarks in both the skull (Chart3.2, Plate 3.6) and the pelvis (Chart 3.3, Plates 3.7 and 3.8) was committed separately, which are listed in the charts below, and ideally identifiable as male or female according to its shape, by macroscopic observation and comparison with the reference collection of the ASP laboratory or with literature references (including comparative photographs and designs). Finally, the sum of all values will enable us to determine the sex of the

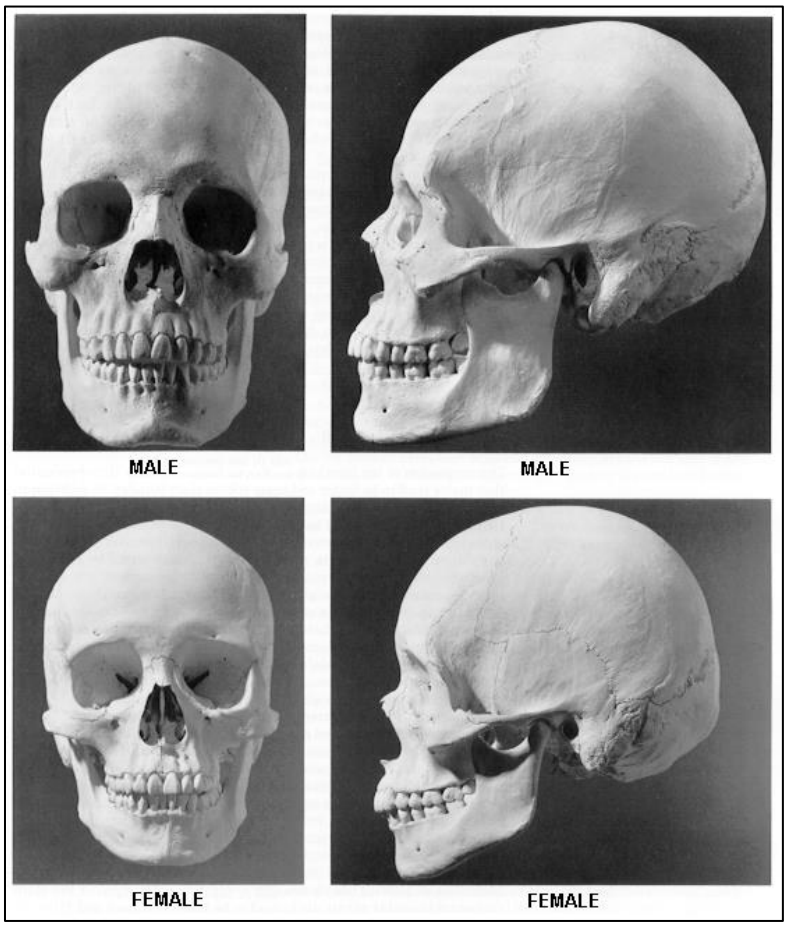


PLATE 3.5. Sexual dimorphism present between both genders in the skull and the pelvic griddle (From: WHITE, BLACK, FOLKENS, 2012, pp.409, 417).

individual, depending on whether more values of one sex or the other among those granted to each landmark is repeated.

In case this method is not applicable (no skull or pelvis present, or are highly fragmented, etc), it is possible to employ other methods based on the measurement of various bones and compared to "cut off" or discriminant equations (methods of osteometrical-statistical basis): the maximum length of the tibia, the vertical length of the glenoid fossa or diameter of the head of the humerus are just some examples (WHITE, FOLKENS, 2005, pp.387-392). Although the present study is based in the methodologies referred, since there is not much statistical information of reference in the case of the ancient Philippine populations.

Chart 3.2. CRANIAL LANDMARKS WICH PRESENT DIMORPHIC SEXUAL CHARACTERISTICS (BUIKSTRA, UBELAKER, 1994).

CRANIAL LANDMARKS	FEMININE	MASCULINE
Glabellar profile	Smooth	Prominent
Frontal slope	Vertical	Inclined
Prognatism	Strong	Light
Frontal tuberosities	Marked	Absent
Temporal tuberosities	Smooth	Marked
Supraorbital ridge	Smooth	Marked
Orbital outlines	Circular	Quadrangular
Supraorbital margin (section)	Pointed	Rounded
Zygomatic bone	Low and smooth	High and rough
Mastoid process	Small	Large
Suprameatal/supramastoid crest	Short (till the acoustic meatus), curved	Long, more straight
External occipital protuberance	Small	Large
Occipital condyles	Small	Large
Palette	Small, short, parabolic	Big, long, "U"-shaped
Nuchal crest	Smooth	Marked
Mental protuberance	Small and rounded	Large and projected
Lower mandibular margin	Thin	Thick
Goneal angle of the mandible	Obtuse and smooth	Perpendicular and everted
Ascending ramus (mandible)	Narrow	Broad

Chart 3.3. PELVIC LANDMARKS WICH PRESENT DIMORPHIC SEXUAL CHARACTERISTICS (BUIKSTRA, UBELAKER, 1994).		
PELVIC LANDMARKS	**FEMININE**	**MASCULINE**
Overall shape	Low and broad	High and narrow
Pelvic inlet	Oval and broad	Hearth-shaped and narrow
Subpubic angle	Open	Close
Iliac crest (vertical margin)	Sinuous	Angulated
Acetabulum (femur articulation)	Small	Large
Greater sciatic notch	Obtuse, "U"-shaped	Sharp, "V"-shaped
Auricular surface	Relieved	Leveled
Compound arch	Falls inside the arch	Prolonged (isquial incision)
Preauricular sulcus	Developed	Not developed
Pubic symphysis	Short	Large
Ventral arch	Present	Missing
Subpubic concavity	Concave	Straight
Isquio-pubic ramus (medial)	Thin	Thick
Obturator foramen	Triangular	Ovoid
Isquial tuberosity	Small	Large
Isquial spine	Pointed	Rounded
Alae (sacrum)	Large	Narrow
Anterior curve of the sacrum	S1-S3	S1-S5
Auricular surface of the sacrum	S1-S2	S1-S3

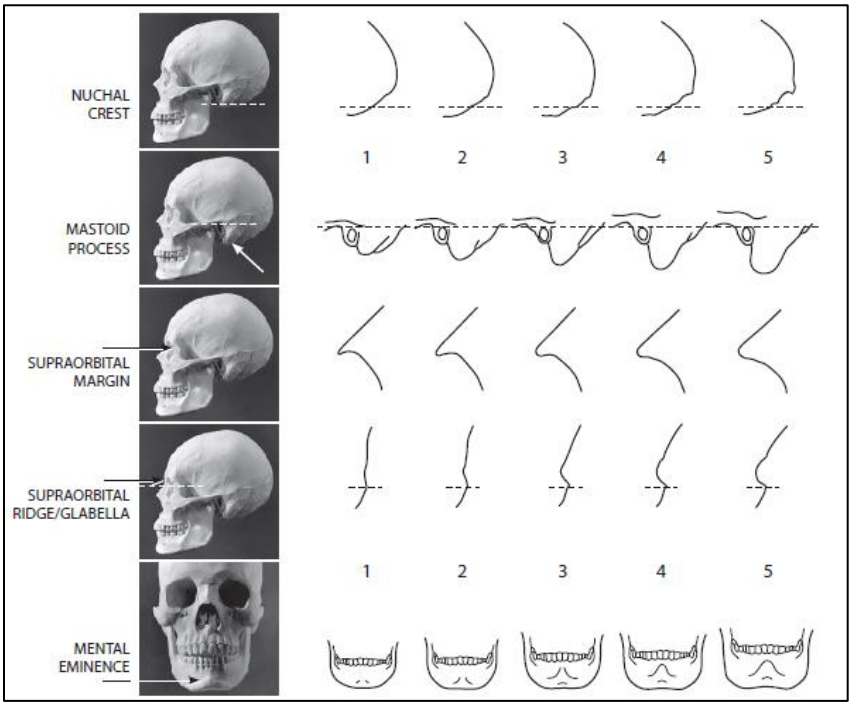


PLATE 3.6. Sexual dimorphism in skull landmarks (From: WHITE, FOLKENS, 2005, pp.390-391).

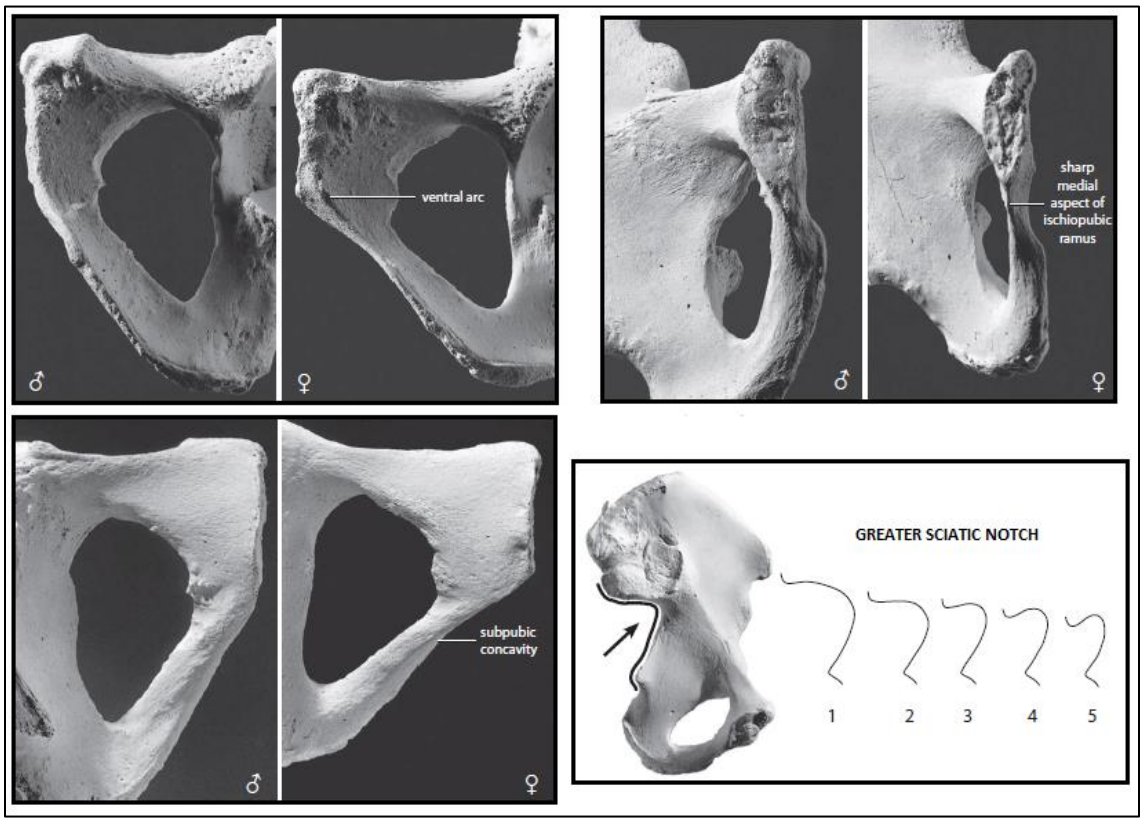


PLATE 3.7. Some of the pelvic landmarks which present sexual dimorphism (From: WHITE, FOLKENS, 2005, pp.393-397).

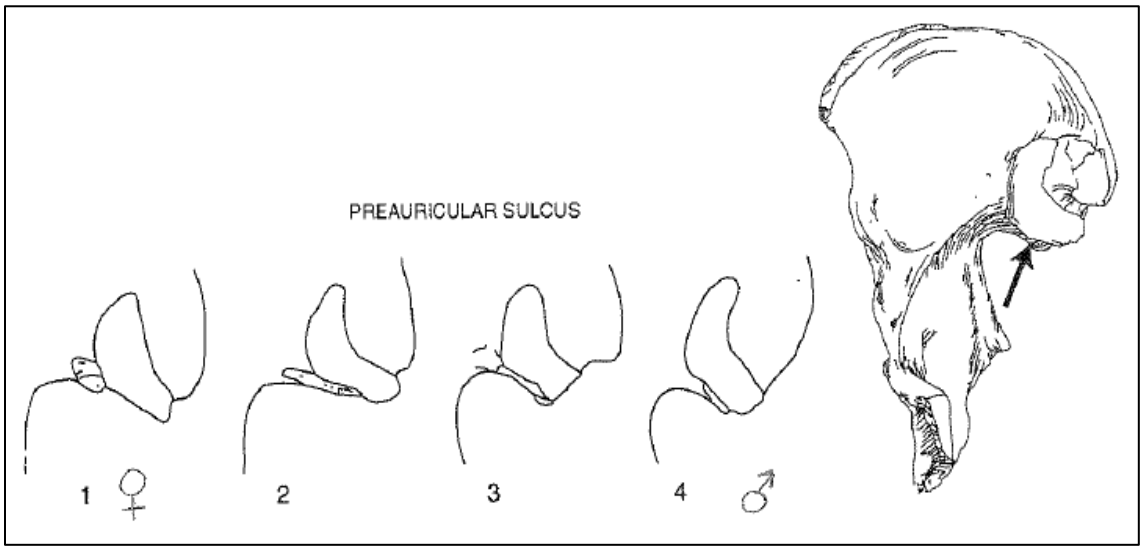


PLATE 3.8. Variations in the shape of the pelvis preauricular sulcus between male and female individuals (From: BUIKSTRA, UBELAKER, 1994, pp.19).

3.5. DETERMINATION OF THE AGE AT DEATH.

Growth processes are also reflected in the human skeleton, and so does the degenerative processes that lead maturity to senescence. The reflection of them will serve, in a similar way to that seen for sexual determination, to identify the age that the study subjects had reached before death.

While sometimes a method can give a largely reliable result, is always better to use several to get more accurate conclusions. Therefore, all possible methods had been applied in each case exposed below.

It is important to consider two factors before exposing the various methodologies used to determine the age:

- The younger the person, the more accurate the age we get as result of our analysis, given the homogeneity of the processes of growth compared to the individual irregularities of physical deterioration in the elderly (WHITE, FOLKENS, 2005, pp.363).
- We can´t give an exact number as result of our ageing process: the result of our analysis is always given by an approximate range of years (WHITE, FOLKENS, 2005, pp.364).

To express these age ranges, resort to the following table of intervals (Chart 3.4. - BAKER *et al.* 2005; BUIKSTRA, UBELAKER, 1994):

Chart 3.4. AGE RANGES IN THE AGE DETERMINATION PROCESS (BAKER *et al.* 2005).

AGE	INTERVAL
Neonate	<1 month old
Infant	<1 year old
Child	1 year old-puberty
Sub-adult/juvenile	Puberty-20 years old
Young adult	20-34 years old
Middle adult	35-49 years old
Old adult	>50 years old

- **3.5.1. Degree of fusion of the epiphysis.**

The first method to determine the age of an individual may be the degree of fusion of the epiphysis of various bones of the skeleton (MCKERN, STEWART, 1957), a method especially useful for infant-juvenile cases, but which fails for adults, since the last epiphysis which is completely fused, the medial epiphysis of the clavicle, closes in around 30 years old. The peculiarity of this method is that the merging of the various epiphysis occur in a predictable sequence (as in Plate 3.9), so if we look at the progress status in the merger of them we can define more precisely the age range in which the individual was (with the limit, as we say, in >30 years old, when all appear fused and the method is not so useful anymore).

- **3.5.2. Fusion of the cranial sutures.**

Another similar method is to analyze the level of fusion of the cranial sutures (MEINDL, LOVEJOY, 1985), which also reach various levels of fusion throughout life and in a certain order, to finish reaching the status of obliteration (maximum degree of closing). In this case it is a useful method for individuals who exceed 30 years of age, when these sutures begin to fuse significantly.

There are two sub-methods which focus in different cranial sutures, always analyzed from the external surface of the skull (MEINDL, LOVEJOY, 1985):

- Method of the cranial vault: sutures 1-7 (midlamboid, lambda, obelion, anterior sagittal, bregma, midcoronal and pterion).
- Lateral-anterior method: sutures 6-10 (midcoronal, pterion, sphenofrontal, inferior sphenotemporal and superior sphenotemporal).

Depending on the level of fusion, a different value is assigned to each suture (0 = open, 1 = starting to obliterate, 2 = almost obliterated, 3 = completely obliterated), always looking to the point indicated in the lower charts (Plate 3.10), with a maximum expansion of 1 cm around it, and subsequently the values of the two methods are added separately. The score will have a range of age associated as a result, range which we can obtain from the reference chart (always taking into account the standard deviation associated with the result, also expressed in the charts).

- **3.5.3. Eruption of the teeth.**

The third method by which we can determine the age is the eruption of teeth (UBELAKER, 1989), since the replacement of deciduous teeth ("milk" teeth) by the permanent teeth (20-32 teeth) also follows a rhythm and order along constant growth process, reaching its final state around 32 years old (approximate limit of the method, although it varies greatly between individuals), as in Plate 3.11.

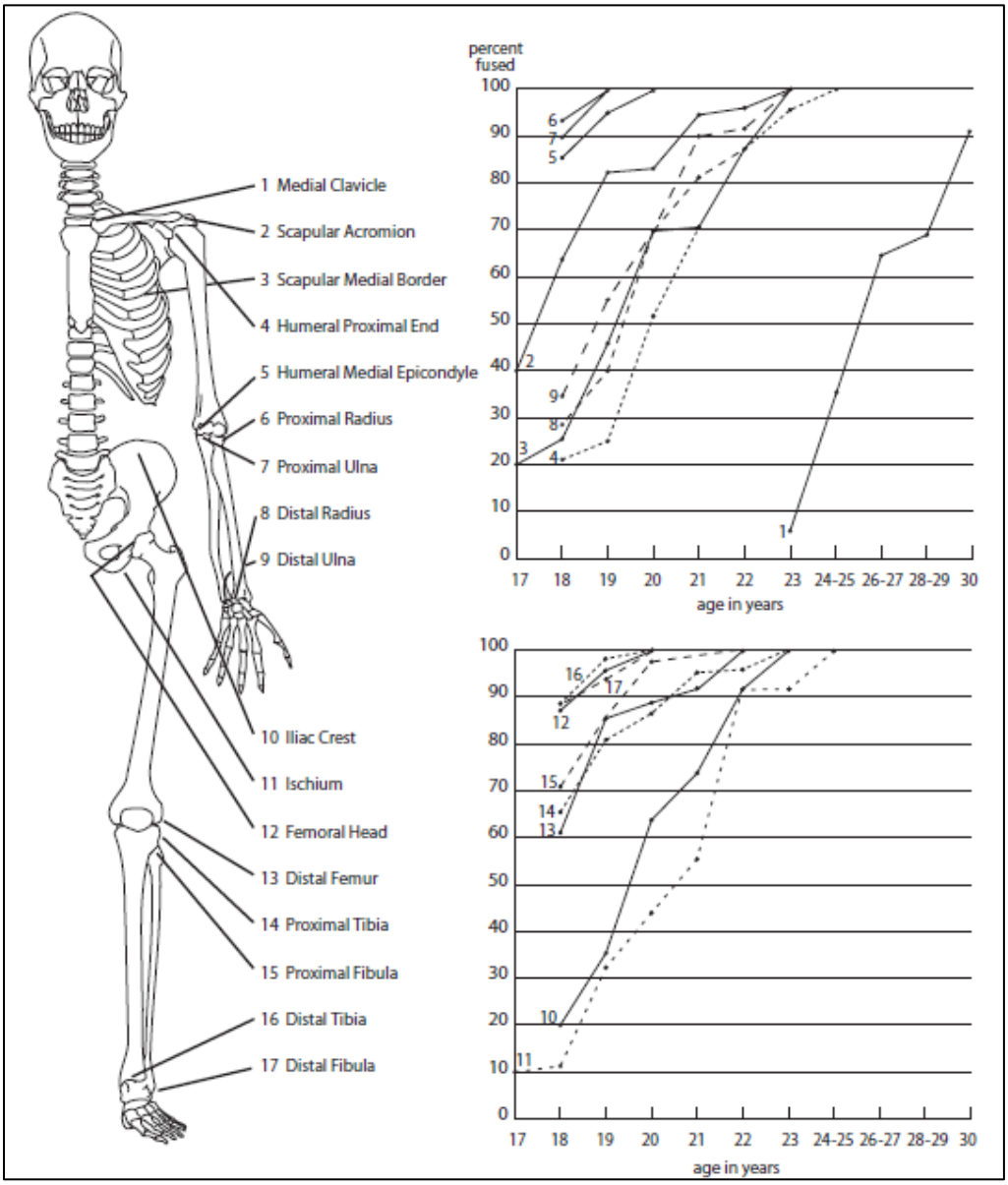
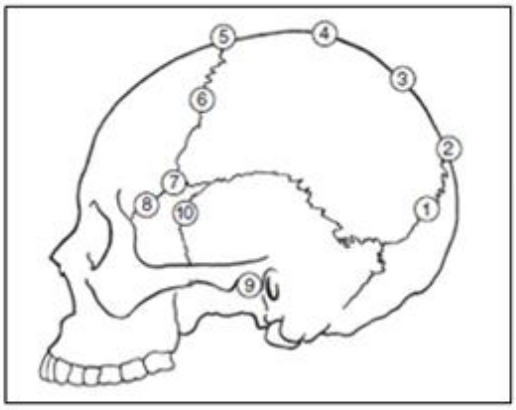
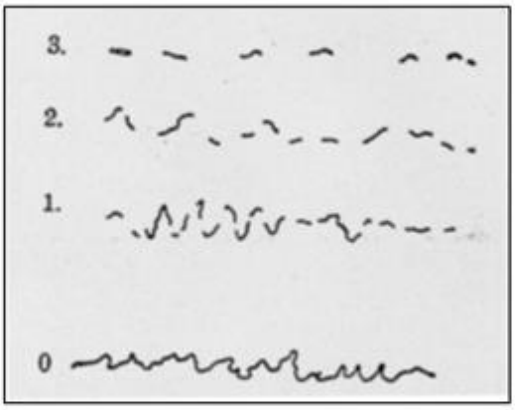


PLATE 3.9. Diagram which displays the different ages of fusion for various skeletal elements, based on male individual (From: WHITE, BLACK, FOLKENS, 2012, pp.395).





CRANIAL VAULT METHOD		
SCORE	AGE	DEVIATION
0	-	-
1-2	30,5	9,6
3-6	34,7	7,8
7-11	39,4	9,1
12-15	45,2	12,6
16-18	48,8	10,5
19-20	51,5	12,6
21	-	-

LATERAL-ANTERIOR METHOD		
SCORE	AGE	DEVIATION
0	-	-
1	32	8,3
2	36,2	6,2
3-5	41,1	10
6	43,4	10,7
7-8	45,5	8,9
9-10	51,9	12,5
11-14	56,2	8,5
15	-	-

PLATE 3.10. Location of the different cranial sutures (superior, left) and diagram which explains the different grades of fusion of them (superior, right). In the inferior charts, we can observe the age ranges expected trough the adding of values by the two different submethods (From: WHITE, BLACK, FOLKENS, 2012, pp.392).

- **3.5.4. Tooth wear analysis (Brothwell).**

Teeth also help determine the age of the owner if we consider the level of tooth wear: comparative tables of Brothwell (like the one included in Plate 3.12: BROTHWELL, 1981) allow us to establish several approximated age ranges in each population, considering the progressive wear of the teeth throughout life, because of the attrition process. The method is not useful in cases of non-natural wear patterns: abrasion, dental modification and alterations as a result of a specific activity. Hence, as shown in the Plate 3.9, the third molar appears in the second age group, and is the last in suffering the wear at the end of the process.

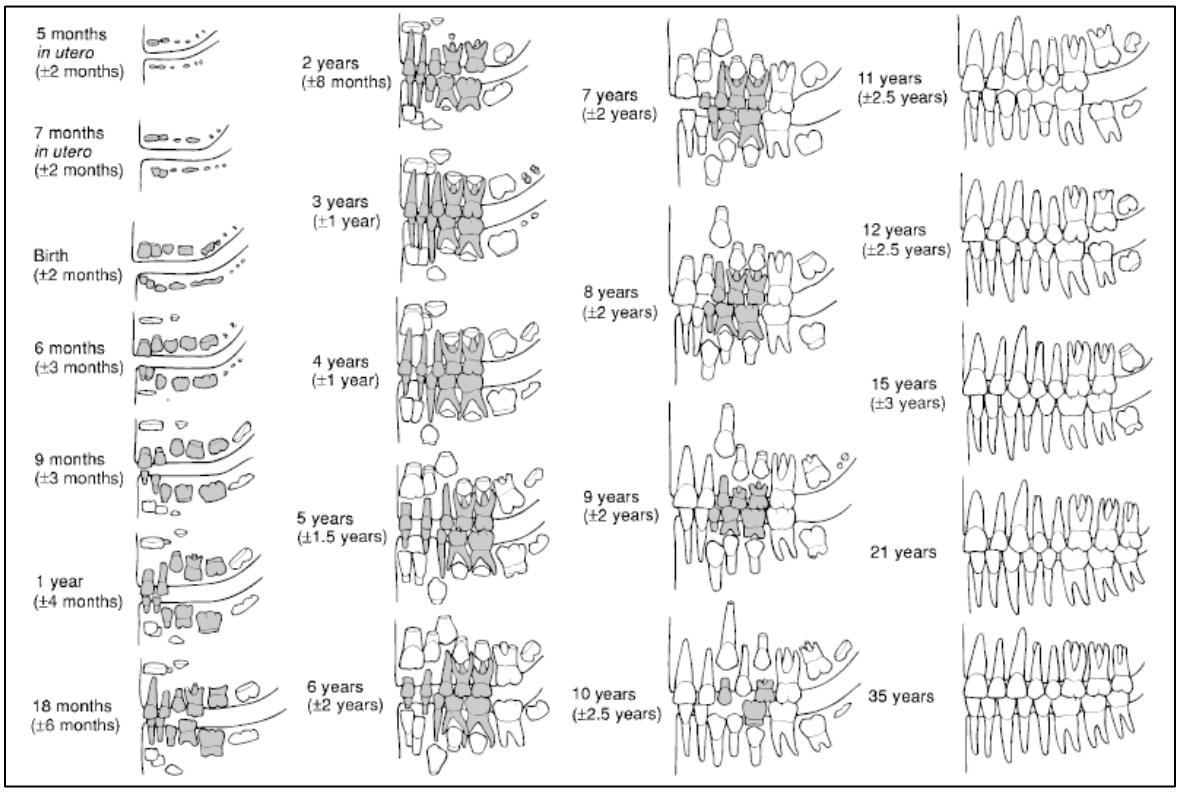


PLATE 3.11. Dental development over native American populations, according to Ubelaker 1989 (From: WHITE, BLACK, FOLKENS, 2012, pp.386).

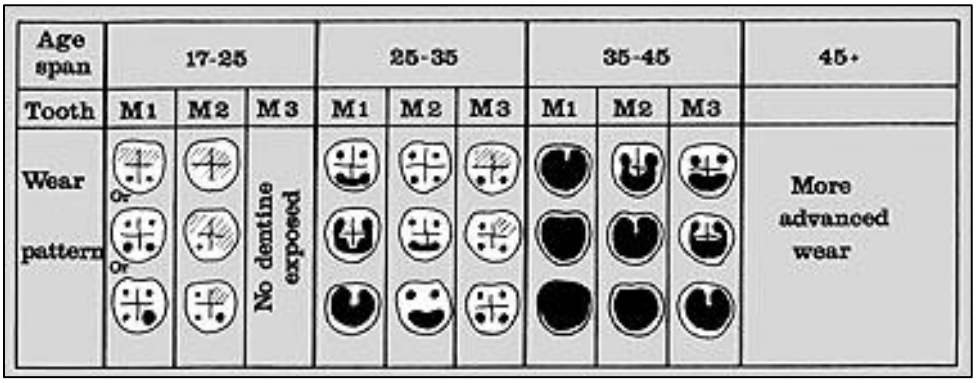


PLATE 3.12. Tooth wear patterns related to age, from a sample of prehistoric-medieval skeletons from the UK, as in Brothwell 1981 (From: WHITE, BLACK, FOLKENS, 2012, pp.390).

- **3.5.5. Pubic symphysis surface.**

Another interesting method of determining age is the method of the pubic symphysis (BROOKS, SUCHEY, 1990), which also noticed that this surface thereof suffers a degenerative process throughout life, which is also slightly distinguishable depending on

sex. The description of each phase and the comparison with the images published by both authors (Plate 3.13) make this one of the methods that allows a greater accuracy: we just analyze the material we have and compare it with their descriptions and their sequence of images of the process, we assign a degenerative process phase, and finally we compare with the reference tables (organized by sex) in order to get a quite accurate age range (Chart3.6).

The description of each phase of this degenerative process (rated from 1 to 6, as follows) is presented in the next table (Chart 3.5).

Chart 3.5. DEGENERATIVE PROCESS IN THE SURFACE OF THE PUBIC SYMPHYSIS (as in BROOKS, SUCHEY, 1990).

PHASE	DESCRIPTION OF THE SURFACE
1	The surface of the pubic symphysis appears covered with an undulating surface (mountains and valleys of horizontal layout). Ossification nodules may appear at the top, but at this stage the inferior limit does not appear yet.
2	Nodules begin to appear defining the bottom edge of the pubic symphysis, and also on the top limit if they didn´t had developed from the start of the process. You can begin to glimpse a lifting of the central area, or a wall on the undulating surface of the ventral side.
3	Upper and lower limits are shown, as well as the wall on the ventral edge. Is already possible to notice some degeneration in the undulating surface.
4	The surface of the pubic symphysis goes from wavy to grainy, but may be still visible remains of the undulating surface. The wall of the ventral side is closed with the upper and lower limits, and also develops on the outside, leading to a marked oval boundary around the entire surface. Lipping may appear in the dorsal edge, as well as some brands in the ventral ligament.
5	Smooth surface completed, fine sandy texture, the surface is shown as a depression with respect to the edge of it. Degeneration and possible rupture of the ventral upper edge. More lipping and ligament brands.
6	Erosion of the edge and wall, erratic ossification processes which give the surface a rough appearance.

PLATE 3.13. The Suchey-Brooks pubic symphysis scoring system, in which we can observe different status of degeneration of it surface for each gender (From: WHITE, BLACK, FOLKENS, 2012, pp.399).

Chart 3.6. CORRELATION OF THE CHANGES NOTICED IN THE PUBIC SYMPHYSIS AND THEIR AVERAGE AGE RANGES (as in BROOKS, SUCHEY, 1990).

	FEMININE SEX			MASCULINE SEX		
PHASE	AVERAGE AGE	DEVI-ATION	95% RANGE	AVERAGE AGE	DEVI-ATION	95% RANGE
1	19,4	2,6	15-24	18,5	2,1	15-23
2	25	4,9	19-40	23,4	3,6	19-34
3	30,7	8,1	21-53	28,7	6,5	21-46
4	38,2	10,9	26-70	35,2	9,4	23-57
5	48,1	14,6	25-83	45,6	10,4	27-66
6	60	12,4	42-87	61,2	12,2	34-86

- **3.5.6. Auricular surface of the ilium.**

Finally, there is another method for calculating the age also based on the degeneration of another contact area in the skeleton: the method of the auricular surface of the ilium (LOVEJOY *et al.*, 1985). This area also suffers a progressive degeneration (as seen in Plate 3.14), so LOVEJOY *et al.* also described phases in a similar way to the previous method (section 3.5.5: pubic symphysis method), which also comes with sample images, as displayed in Plate 3.11, so that the method again is based on the comparison (after sexing, because this method also distinguishes between both sexes) and the recurrence to reference tables to establish the age of the individual being studied, based on their equivalence with one of said stages of the degenerative process. These stages of degeneration have been ranked from 1 to 8, as follows (Chart 3.7).

Chart 3.7. STAGES OF DEGENERATION OF THE AURICULAR SURFACE OF THE ILIUM AND AGE RANGES ASOCIATED (as in LOVEJOY *et al.*, 1985).

STAGE	AGE RANGE	DESCRIPTION OF THE SURFACE
1	20-24 years	Undulating surface with a fine grain.
2	25-29 years	Less undulating, but retains a youthful look.
3	30-34 years	Stretch marks begging to appear, thickening granulometry.
4	35-39 years	Coarse grain size throughout the surface uniform.
5	40-44 years	Transition to a dense surface, usually in "islands".
6	45-49 years	Fully dense surface without grain.
7	50-59 years	Dense and wrinkled surface, periauricular moderate activity.
8	>60 years	Marginal lipping, microporosities, preauricular irregularities.

Of course there are countless other studies on various methods of calculating age (looking from the external extremity of the ribs to the structure of the spongy tissue of the proximal epiphysis of the humerus or femur, within others: WHITE, FOLKENS, 2005, pp.381-385),

but the ones shown here are the most frequent and, therefore, we have decided to base our study on its functionality.

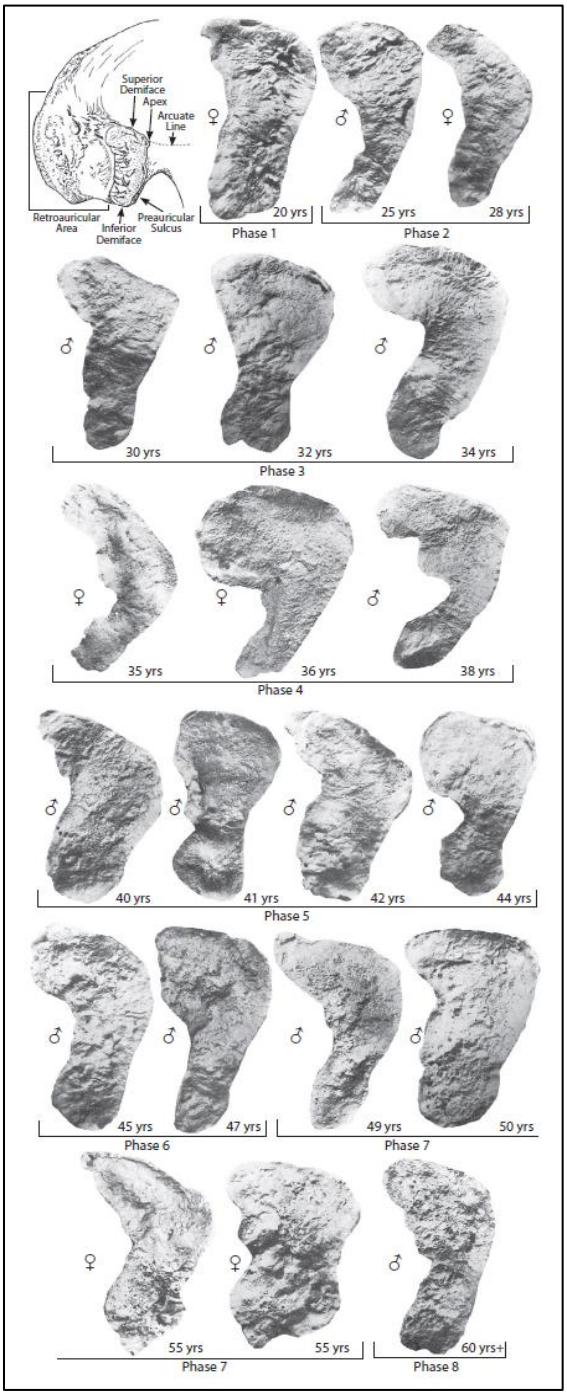


PLATE 3.14. Modal changes to the auricular surface of the ilium within ages, as in Lovejoy *et al.* 1985 (From: WHITE, BLACK, FOLKENS, 2012, pp.400).

The data related to sexual diagnosis and estimation of the individual's age were also recorded in the corresponding record file model (Chapter 3.7), which also will be attached to this work (Annex II).

3.6. DETERMINATION OF PALEOPATHOLOGIES AND DIFFERENTIAL DIAGNOSIS.

As for the registration of paleopathologies which we carried out on each individual, again the direct macroscopic observation would be the procedure to follow: the location of the different markers associated with each disease. Through the study of symptoms we could understand what kind of pathological condition was affecting each individual, as well as analyzing also which anatomical region would suffer this aim.

For the diagnosis of every disease we turn to two sources that facilitated the comparative study:

- Bibliography and photographs on paleopathology and current pathology. Atlases of paleopathology offer a good first approximation, since they distinguish and classify the various ailments according to the markers present in the osteological material, giving good definitions of the symptoms of each disease and offering visuals (photographs, X-rays, etc.) that allow us to establish comparative relationships. For more specific cases, the consult of specialized references about particular pathologies or case studies was also committed.
- Reference collection: the comparison with other cases present in the human osteology laboratory of ASP.

It is also important to introduce a concept from the current medical science here which also becomes a basic tool in paleopathology studies when defining the disease that we face: the differential diagnosis, which involves distinguishing a disease or condition within others presenting similar signs and symptoms (BUIKSTRA, UBELAKER, 1994, pp.107-112). This process of weighing the probability of one disease versus that of other diseases was used in cases of nosological charts which presented similar manifestations, in order to discard those farthest options to the real ones.

Is also relevant to understand that all diagnoses offered in this and other works on paleopathology are always presumptive diagnosis (ROBERTS, MANCHESTER, 2010, pp.33-34): even in modern medicine is sometimes difficult to determine exactly pathology; in paleopathology we use to arrive at our diagnosis by exclusion, differential diagnosis, what sometimes is not enough to prove, as required by the clinical medicine of our time.

All information and photographs obtained in relation to each individual paleopathological study were recorded in the corresponding file model (*vid* infra: 3.7) and organized in a files catalog which we present appended to this paper (Annex III).

3.7. MICROSCOPICAL ANALYSIS AND X-RAY: COMPLEMENTARY TECHNIQUES.

When was expected to get some data not shown from direct inspection of human remains, also two complementary techniques where used, that serve to guide with certainty the nature of the injury:

- Microscope and binocular lenses (Plates 3.15 and 3.16). The use of a microscope (model SMZ-745 C-Leds of Nikon), in which a digital camera was implemented (Nikon D5000) was really useful both for the determination of pathological marks impossible to detect macroscopically, and also for documenting them through photography (this technique was used mainly in cases of DEH or in some unusual dental patterns).
- X-Ray (CHHEM, BROTHWELL, 2008). Radiological analysis was also required for the diagnosis of three different pathologies of three different individuals from Ille. The UP Health Services equipment and human resources participated in this part of the project. Digital radiography was done over the individuals, focusing in the anatomical regions of interest, in which a previous macroscopical analysis was done in the osteology laboratory.

PLATE 3.15. The use of binocular lenses was especially useful during the laboratory analysis, especially for a first microscopical evaluation which didn´t pretend to get into deeper proceedings.

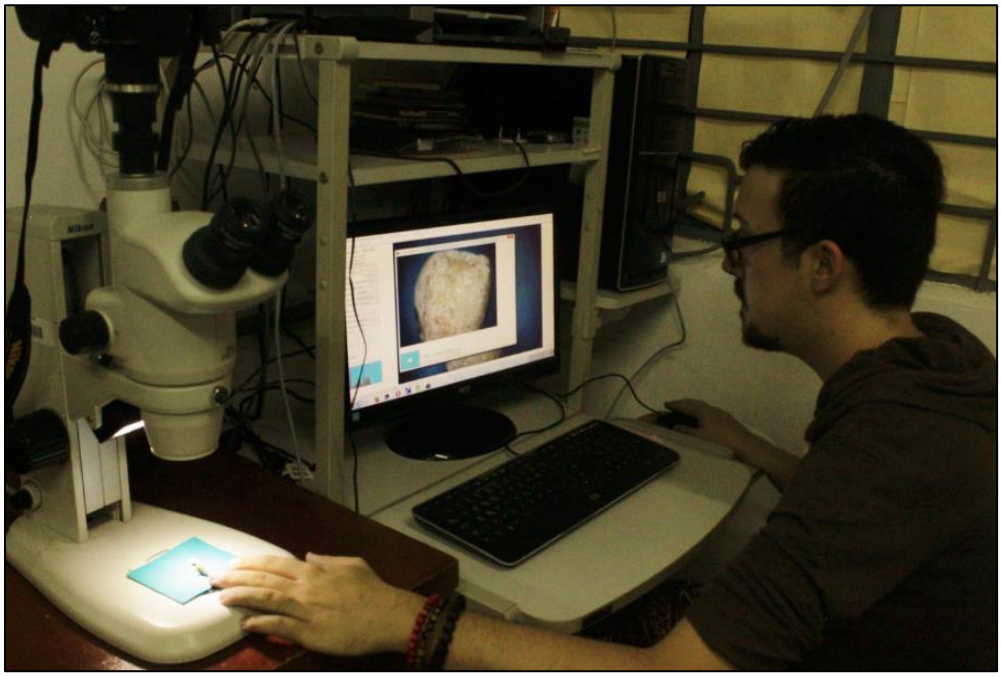


PLATE 3.16. Thanks to the connection of our reflex camera (Nikon D500) to the microscope, and trough USB connection to a computer, using the software of the own camera, we were able to prepare a microscope which would allow us to make our observations trough the computer screen in a more comfortable way, and also to take photographical series for documenting our work.

3.8. THE DATA COLLECTION PROCESS AND THE CONSTRUCTION OF A FILE CATALOGUE.

All data obtained both in relation to inventory, sexual diagnosis, estimation of the individual's age and pathologies present in each case were collected using a digital records system (Microsoft Excel™) which is described and presented as many annexes to the next work (Annex I-III), as a file catalog data collection:

- Inventory and bone description files: include the different anatomical regions with a list of all the bones in them, so that was possible to specify if they were present or not, and also make a brief description about preservation (number of fragments, percentage of the bone present, missing parts, etc).
- Biological profile I (sex and age) files: the results of all the different approaches presented before in both cases (3.4. and 3.5.).
- Biological profile II (paleopathologies) files: compilation of every pathology registered in each individual (organized by groups: degenerative joint diseases, trauma, dental pathology, infectious, non-specific, etc), describing the symptoms and its location, explaining the reasons for the differential diagnosis and attaching illustrations.

4. THE RESULTS OF THE ANALYSIS. PALEOPATHOLOGIES DOCUMENTED IN THE HUMAN REMAINS FROM ILLE.

NOTE: For reasons of space and narrative, to ease the reading of the results, it has been chosen to maintain the differential diagnosis of the pathologies in the files catalogue (Annex III).

4.1. INTRODUCTION: THE RESULTS OF SEX AND AGE DETERMINATION.

The laboratory study, brought from the techniques and methodologies described in Chapter 3, let to study a total of 20 individuals for the period and ageing range defined for our work, a minimum number of individuals (MNI) which coincided with the sample of context numbers selected for the study (Chapter 3.2).

The determination of the stature of the individuals is not part of the study because of the preservation status made impossible the analysis, as already explained in Chapter 1.2.

About the age and sex determination of the individuals analyzed, the following situations could be defined:

- **4.1.1. Age estimation (Chart 4.1).**

Of the 20 individuals analyzed, we could age 11 cases, and all of them formed part of our study, since they were adult individuals.

9 cases which couldn´t be aged, presented such a poor status of preservation that no pathologies where registered in them. As displayed at the chart below (Chart 4.3), in which up to 9 individuals which didn´t show evidence of pathological lesions where recorded, sexual diagnosis and estimation of the age of these individuals wasn´t also possible, since their condition was really fragmented (for example, in the case of context 1911) or the anatomical regions represented didn´t allow us to commit such studies (context 1245, context 1803).

- **4.1.2. Sex determination (Chart 4.2).**

The determination on 6 of the 20 individuals was also accomplished. The rest of them couldn´t be sexed (recorded as indeterminate sex, "*Indet.*"), being 9 of them part of the group of skeletons which were badly preserved (*vide supra*: 4.5), and which also couldn´t be aged nor presented pathological results.

The other 6 individuals presented pathologies:

- 2 clearly male.
- 1 a probable male.
- 0 clearly female.
- 3 probable female.

Chart 4.1. RESULTS OF THE AGE DETERMINATION PROCESS COMMITED IN OUR LABORATORIAL ANALYSIS.

AGE GROUP	INDIVIDUALS	AGE RANGE	CONTEXT NUMBERS
Young adult	4	20-34 years old	67, 755, 800, 1825
Young-middle adult (intermediate)	2	20-49 years old	907, 2247
Middle adult	2	35-49 years old	727, 1337
Old adult	0	>50 years old	-
Adult (indeterminate age range)	3	>20 years old	484, 703, 2240
+ Indeterminate age (without pathology)	*9*	-	*23/B1?/1803, 485, 874, 911, 1245, 1911, 1931, 2239, 2253*

TOTAL: 20 INDIVIDUALS ANALYZED, 11 AGED.
All indeterminate age ranges correspond to individuals which didn´t show pathological conditions.

Chart 4.2. RESULTS OF THE SEXUAL DIAGNOSIS PROCESS COMMITED IN OUR LABORATORIAL ANALYSIS.

SEX	INDIVIDUALS	CONTEXT NUMBERS
Clearly male	2	67, 2247
Probable male	1	755
Clearly female	0	-
Probable female	3	727, 800, 1337
Indeterminate	5	484, 703, 907, 1825, 2240
+ Indeterminate (without pathology)	*9*	*23/B1?/1803, 485, 874, 911, 1245, 1911, 1931, 2239, 2253*

TOTAL: 20 INDIVIDUALS ANALYZED, 6 SEXED.
5 out of 14 of the indeterminate sex individuals showed pathological conditions.

4.2. PALEOPATHOLOGIES REGISTERED IN THE ASSEMBLAGE.

As explained before (Chapter 4.1), of the total of 20 individuals studied, 11 of them had positive results in terms of identifying pathologies, all of them also sexed (Chapter 4.1.2), being the previously discussed 9 cases of bad preservation status the ones which didn´t offer positive results (4.1.1).

In this groups of 9 adults which presented pathologies, the distribution of age ranges was as follows:

- 4 young adults (20-30 years old).
- 2 middle adults (35-49 years old).
- 0 old adults (>50 years old).
- 2 young-middle adults.
- 3 adults.

Chart 4.3. ANALYZED PREHISTORIC INDIVIDUALS FROM ILLE CAVE WHICH DIDN´T PRESENT ANY PATHOLOGICAL CONDITION.

**The individuals from this list were not registered in the sheet catalogue.*
***Indeterminate sex/age based in diagnosis tentative during labwork and references to the ASP inventory.*

CONTEXT Nº.	SEX	AGE	PRESENT BONES
23/B1?/1803	Indeterminate	Adult	Both legs (femur x2, patella x2, tibia x2, fibula x2) and both feet bones (all).
485	Indeterminate	Indeterminate	Humerus fragments, clavicles (x2), scapula (x2), ribs, pelvic fragments, sternum, sacrum.
874	Indeterminate	Indeterminate	Calotte fragments.
911	Indeterminate	Indeterminate	Skull (splanchnocranium and mandible fragments, no teeth), vertebral fragments, rib fragments, humerus (x2), tibia (x2), femur (x2), feet (x2).
1245	Indeterminate	Subadult?	Fragmented skull.
1911	Indeterminate	Indeterminate	The skeleton was so fragmented that it was impossible to determinate sex, age or the presence of any disease.
1931	Indeterminate	Indeterminate	Calotte fragments, humerus x2, scapula x2, rib and vertebrae fragments.
2239	Indeterminate	Indeterminate	Skull and mandible (no teeth), vertebrae, ribs, scapula (x2), clavicle (x2), arms (x2), left hand, sternum.
2253	Indeterminate	Indeterminate	Femur x2, pelvic griddle fragments.

Two groups of pathological conditions have been registered in the assemblage, according to their anatomical location:

- Dental pathologies (Chart 4.5): diseases affecting the teeth, the mandible and/or the maxilla. Several variables have been documented: signs of infection (root exposure, infectious tissue in the alveolar surfaces, calculus, caries), AMTL (*ante mortem* tooth loss), DEH (dental enamel hypoplasia, also referred in the specific bibliography as LEH, linear enamel hypoplasia) and different patterns of teeth wear (both natural and as a result of the attrition process, as a result of the implication of the teeth in different kind of cultural-economical activities).
- Non-dental pathologies (Chart 4.6): all those documented diseases outside the mouth, which were classified into different groups. Various cases of degenerative joint diseases were registered (Schmorl's nodes, osteoarthritis in the column or other joints, and also non-specific joint diseases), as well as infectious diseases (periostitis, osteitis, osteomyelitis), metabolic diseases (cribra orbitalia) and a few cases of traumatism (some cases of healed fractures).

In the following pages, the summary charts of the results of the analysis are displayed, both for the age (Chart 4.1) and sex determination (Chart 4.1), and also the distribution of the different pathologies (dental and non-dental paleopathologies) beneath the different groups of sex and age, as well as the different pathological markers.

Chart 4.4. PREHISTORIC INDIVIDUALS FROM ILLE CAVE THAT OFFERED POSITIVE RESULTS IN PALEOPATHOLOGICAL ANALYSIS.
67/709
2240
484/B3
703
727
755
800
907
1337
1825
2247/2251

Chart 4.5. DENTAL PALEOPATHOLOGIES DOCUMENTED IN THE ANALYZED SKELETAL REMAINS FROM ILLE CAVE AND ITS DISTRIBUTION.

*"X" = present, "-" = not documented.
**Question marks represent probable cases in sex determination.
***If not specified (just marked with "X"), pathologies distributed in all the dental pieces/area.

CONTEXT Nº. (SEX – AGE)			ATTRITION (NAT. WEAR)	ABRASION (ARTIF. WEAR)	ROOT EXPOSURE	CAL-CULUS	ALVEOLAR INFECTION	DENTAL ENAMEL HYPOPLASIA	CARIES	OTHERS (SPECIFY)
67	♂	*young adult*	X	-	X	X	X	Max: R&LI1, R&LI2 Man: R&LC,R&LPM1	-	Enamel pearl (max. LM3)
484	*Ind.*	*adult*	*No pathological lesions registered (mandible, maxilla and dentition not present)*							
703	*Ind.*	*adult*	*No pathological lesions registered (mandible, maxilla and dentition not present)*							
727	♀*?*	*middle adult*	X	Mandibular molars	X	X	-	Max: R&LC Man: R&LI1, LI2, R&LC	-	-
755	♂*?*	*young adult*	X	Mandib. incisives and canines	X	X	X	Man: RC	Mandib. L/RM2-3	-
800	♀*?*	*young adult*	X	-	-	-	-	-	-	-
907	*Ind.*	*yg-mid. adult*	X	-	X	X	X	-	-	-
1337	♀*?*	*middle adult*	X	-	X	X	X	Max: LI1, RI2, R&LC Man: R&LI1, RI2, R&LC	-	*Ante mortem* tooth loss (max. RM3)
1825	*Ind.*	*young adult*	X	-	X	-	-	-	-	-
2240	*Ind.*	*adult*	*No pathological lesions registered (mandible, maxilla and dentition not present)*							
2247	♂	*yg-mid. adult*	X	Mandib. incisives and canines	X	X	X	Max: R&LI1 Man: LC	Mandib. LM1-3	-

Chart 4.6. NON-DENTAL PALEOPATHOLOGIES DOCUMENTED IN THE ANALYZED SKELETAL REMAINS FROM ILLE CAVE AND ITS ANATOMICAL DISTRIBUTION.

**"X" = present, "-" = not documented.*
***Question marks represent probable cases in sex determination.*

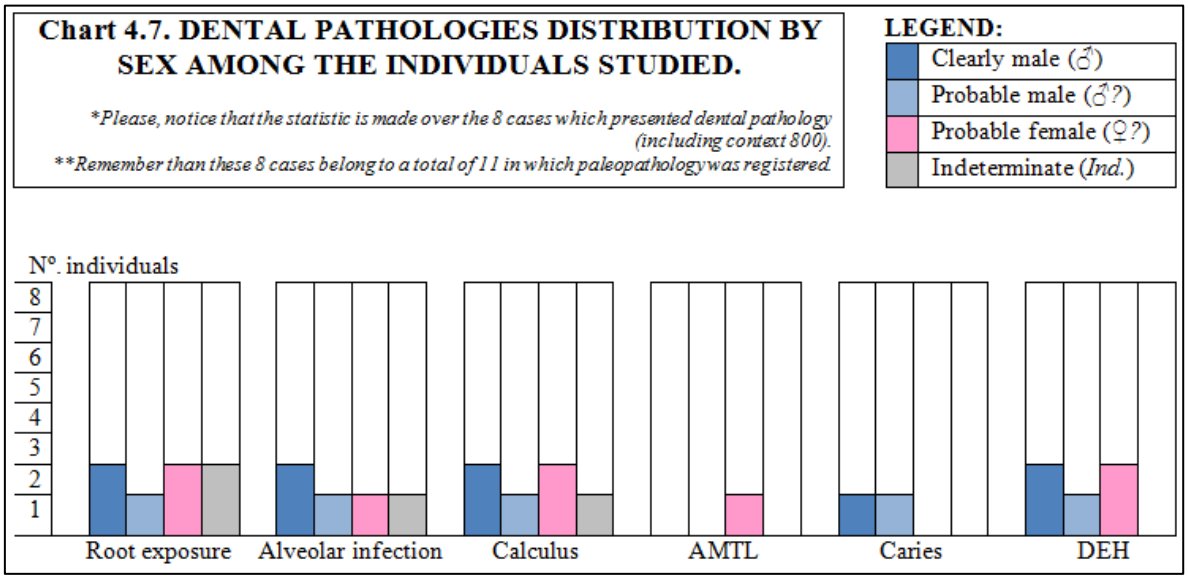
CONTEXT Nº. (SEX – AGE)			OSTEO-ARTHRITIS	SCHMORL NODULES	UNSPECIFIC JOINT DIS.	OSTEITIS	PERIOSTI-TIS	OSTEO-MYELITIS	HYPER-OSTOSIS	TRAUMA	OTHER
67	♂	*young adult*	*No diseases registered (except of dental pathologies)*								
484	*Ind.*	*adult*	-	T8-12, L1	-	-	-	-	-	Costo-vertebral	-
703	*Ind.*	*adult*	-	-	-	-	-	Forearms and legs	-	-	-
727	♀*?*	*middle adult*	All present vertebrae	-	-	-	-	-	-	-	-
755	♂*?*	*young adult*	-	-	Minor cervical marginal lipping	-	-	-	-	-	-
800	♀*?*	*young adult*	-	-	-	-	-	-	Right clavicle sternal end	-	Cribra orbitalia (right)
907	*Ind.*	*yg-mid. adult*	*No diseases registered (except of dental pathologies)*								
1337	♀*?*	*middle adult*	*No diseases registered (except of dental pathologies)*								
1825	*Ind.*	*young adult*	-	-	-	-	-	-	-	Healed fracture (left femur)	-
2240	*Ind.*	*adult*	-	-	Minor lipping (vertebrae and left elbow)	-	-	-	-	-	-
2247	♂	*yg-mid. adult*	C3-4, T4-12, L1-5	L1-5	L5	Pubis	Legs and arms	-	-	Healed fracture (right nasal)	Rower clavicle (stress)

4.3. DENTAL PATHOLOGY.

In 8 of the 20 cases analyzed in Ille Cave, the presence of various dental pathologies was documented, although only one of this cases presented a framework of tooth wear by attrition (because of the condition of the individual from context 800, part of this group: very fragmented, covered with concretions that prevented the analysis of surfaces). In all other individuals (contexts 67, 727, 755, 907, 1337, 1825 and 2247) a series of teeth pathologies where registered; paleopathologies from which we can infer issues of dental health and diet of the study population: exposure of the dental roots, brands of infection in the alveolar surfaces of both maxilla and mandible, *ante mortem* teeth loss (AMTL), accumulations of calculus or caries presence. Meanwhile, other pathologies such as dental enamel hypoplasia (DEH), allow us to approach from the perspective of their subsistence during subadult age.

Unfortunately, given the limited results inferred of the laboratory study (which was positive in the presence of pathologies in only 11 cases out of 20 adults studied, in whose group 8 had the indicated teeth conditions), and the fact that sexual diagnosis offered no decisive results in many cases (only 2 clear male individuals presenting dental pathology, plus a possible male, three possible feminine and two cases where sexual diagnosis was not possible), will not allow us to commit comparative studies between sexes, which could have led to establish dietary or activity differences between the sexes, as has been achieved in other archaeological sites in Southeast Asia later (PIETRUSEWSKY, TSANG, 2003, pp.210; OXENHAM, MATSUMURA, KIM DUNG, 2010, pp.90). The corresponding statistical chart follows (Chart 4.7).

All the results obtained for dental pathology, which will be covered below, will be interesting for inferring certain patterns regarding dental health, diet and some potential activities undertaken within the population represented in the assemblage (Chapter 5).



- **4.3.1. Periodontal disease. Root exposure, alveolar infection, calculus.**

Periodontal disease (ROBERTS, MANCHESTER, 2010, pp.188-190) involves an inflammatory process which responds to the presence of several irritant factors, being the main one the presence of bacterial dental plaque (sticky coating formed by proteins, food particles and both living and dead microorganisms), or specially the calculus deposits (ROBERTS, MANCHESTER, 2010, pp.185-186), result of the mineralization of the plaque, and which can be registered in archeological record in the shape of hard concretions over the tooth surface (normally around the junction area between the crown and the root (ORTNER, 2003, pp.593; HILLSON, 1996, pp.255). The presence of calculus is, then, one of the three markers which allow us to determine a case of periodontitis: in the collection of Ille Cave, all the 6 individuals cited (context numbers 67, 727, 755, 907, 1337 and 2247) presented calculus deposits distributed in the crown-root area of all the dental pieces.

Both plaque and calculus suppose a stimulus for the inflammation of the soft tissues (gums) around the tooth, known as gingivitis. The untreated gingivitis can develop to cases of periodontitis, in which also the alveolar bone suffers the infection (ORTNER, 2003, pp.593). The second marker which permits the diagnosis of this pathology, and which we documented in all the cases of Ille except of the context 727 (bad preservation status) is the presence of reactive alveolar bone around the teeth (alveolar resorption).

An immediate consequence after this loss of alveolar bone caused by the expansion of the infection is the exposure of the dental roots, which is the third indicator that we

should consider for determine the presence of the periodontal disease, and which again we registered in all the individuals of our study. Other possible consequences of the spread of the infection can be the appearance of periodontal abscess (which we couldn´t identify in any case of Ille assemblage), or the affection of the periodontal ligament and the subsequent teeth loss (ORTNER, 2003, pp.594, HILLSON, 1996, pp.262). We can observe an example of all this features in Plate 4.1.

The periodontal disease is the main paleopathology which could be observed in the case of the teeth collection of Ille Cave, which was registered in 6 of the 8 individuals. Because of preservation factors already discussed (Chapter 4.2 introduction) was not documented in the rest of individuals analyzed, and also was not clearly present in the case of context 1825, but the presence in this individual of a case of root exposure could point to another possible case of periodontitis. Also, one of this 6 individuals which gave positive results to periodontal disease, the one from the context 727, doesn´t show signs of alveolar resorption, but other markers of the pathology are present (root exposure and significate calculus), so we can explain the absence of the third diagnostical factor as consequence of the preservation status, which led to a poor conservation status of the alveolar surfaces (concretions in both maxilla and mandible).

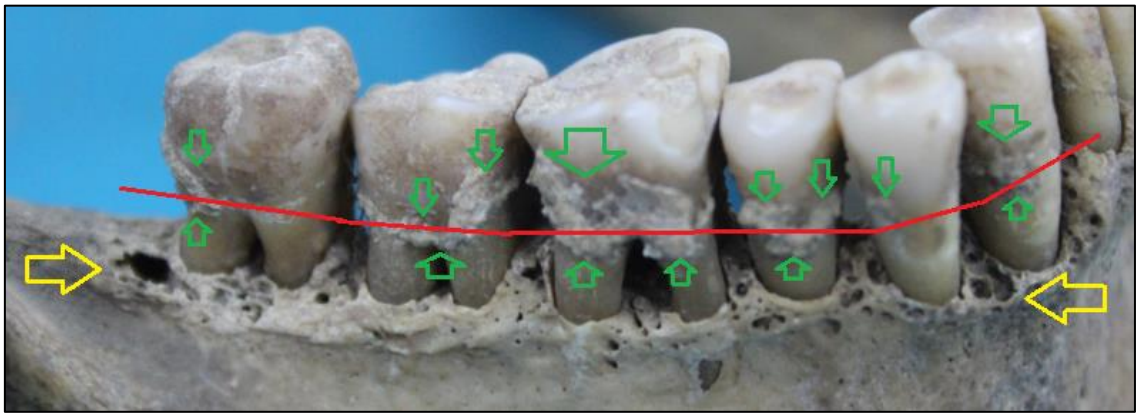


PLATE 4.1. Sample picture displaying the right mandibular molars from context 2247, in which we can observe calculus deposits (green arrows), root exposure (gingival margin before its recession marked in red) and the reactive alveolar bone around the dental insertions (between the yellow arrows).

- **4.3.2. Carious lesions.**

Caries is defined as "a disease process characterized by the progressive decalcification of the enamel or dentine" (WHITE, BLACK, FOLKENS, 2012, pp.455), which normally is the result of the accumulation of dental plaque in the mouth and a diet which includes fermentable carbohydrates. The dental plaque will be the matrix in which a community of acid-producing bacteria (mainly *streptococcus mutans* associated with other secondary contributor bacteria) will inhabit, so the infection will start in the tooth surface, expanding latter into the tooth structure, in both crown and root (this last one in cases of root exposure), and demineralizing the enamel and lately the dentin, destroying both the hard and soft tissues (ORTNER, 2003, pp.590; HILLSON, 1996, pp.270; ROBERTS, MANCHESTER, 2010, pp.171-172).

Macroscopically, the caries can be noticed in several formats: can appear as smooth opaque spots in the crown of the teeth, but also, in more advances status, as cavities or pits of variable size which can affect the teeth surfaces in various aspects (normally in the fissures of the crowns in the occlusal aspect of the teeth, but is also frequent that they appear between the teeth, in the interproximal areas).

In the case of Ille Cave, two cases where registered (context 755, possible masculine, young adult; and context 2247, clearly male, young-middle adult) which correspond to different status in this process: the individual from the context 755 presented some small black pits in the occlusal aspect of the second and third molars of both left and right sides of the mandible, in which the destructive process just affected the enamel; meanwhile, in the case of individual 2247, the caries were registered in the left first molar from the mandible, in the interproximal surface with the second molar, and also in the buccal-labial aspects of both M2 and M3 in the same side. In this second case, the caries lesion appeared with a more advanced aspect: deep black-colored cavities which extended all over the surfaces of the three molars, with a complete destruction of the enamel but also of almost all the dentine, giving the teeth the appearance of being almost emptied.

The Plate 4.2 displays both cases, so than the different status can be observed.

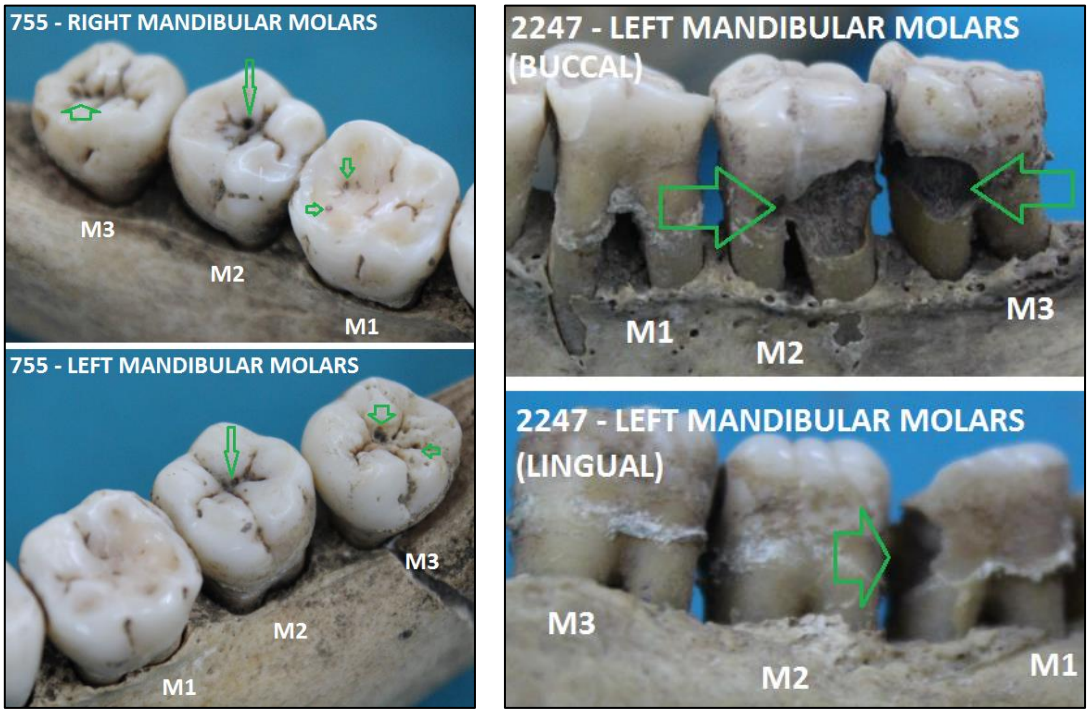


PLATE 4.2. Carious lesions (pointed with green arrows) observed in the mandibular molars of the individual from context 755 (left images) and the right mandibular molars of the skeleton from 2247 (right images).

Normally, as secondary effects of the appearance of dental caries and their development to advanced states, the spread of the infection inside the pulp cavity results in the massive destruction of tissue in the base of the tooth root (ORTNER, 2003, pp.593), and also the creation of pus which would drain through the alveolar process by the creation of an abscess (although, in the case of Ille Cave, no abscess where registered in the studied assemblage, neither associated to the caries presence nor to any other pathological conditions).

- **4.3.3. Ante mortem teeth loss (AMTL).**

Some teeth can be missing during the life of the individuals who suffer different pathological conditions (for example, periodontal disease). In this case, the loss of alveolar bone due to periodontitis, along with the periodontal ligament, which undermines the support structure for the dental pieces (ORTNER, 2003, pp.592-593), can finish with *ante mortem* teeth loss (AMTL). So then, there are several different reasons for the manifestation of AMTL (TOOMAY, DOUGLAS, 2006, pp.193): presence of caries, accidental removal, intentional removal or tooth wear associated to exposition of the pulp.

In the case of Ille Cave, one case of AMTL with alveolar resorption was recorded in the third right molar of the maxilla of the individual from context 1337 (Plate 4.3), a young adult probable female individual. The surface of the alveolar bone clearly suffered a remodeling process, what discards the intentional removal of the tooth. Possibly the tooth finished falling because of the infectious process documented in the rest of the mouth: this individual also presented signs of alveolar infection in both mandible and maxilla, as well as teeth root exposure and the most significant deposits of calculus of all the collection, present in all the dental pieces both in lingual and labial aspects.

PLATE 4.3. *Ante mortem* tooth loss (AMTL) in the space left by the right third molar of the maxilla, part of the skeleton from context 1337 of Ille Cave. Can be observed that the remodeling process has been partially completed.

- **4.3.4. Dental enamel hypoplasia (DEH/LEH).**

An interesting case of abnormal quality of teeth is also typically documented in Southeast Asian ancient populations (Chapter 5), and the case of Ille is also a good example: the dental enamel hypoplasia, which is manifested by the presence of horizontal linear grooves in the surfaces of the teeth, together with a fine porosity all over the enamel (ROBERTS, MANCHESTER, 2010, pp.193-194; ORTNER, 2003, pp.594-595; WHITE, BLACK, FOLKENS, 2012, pp.455-456). The explanation to this

presence of these hypoplastic lines, which is particularly more evident in the maxillary incisives (but which are specially easy to identify in both mandibular and maxillary incisives and canines, as in the case of Ille Cave), is an indicator of the interruption of enamel formation (or amelogenesis) during the teeth formation processes in childhood.

Different factors of stress can stimulate this interruption in the formation of the enamel, always manifested by the individual before the timing for the formation of the dental crowns of the permanent dentition (around 6 years old), and the study of the different sequences of the lines can give us clues about the age in which the individual suffered this stress periods: trauma, infections, malnutrition, poor oral hygiene, etc (ORTNER, 2003, pp.595).

In the case of Ille Cave, DEH was registered in 5 of the 8 individuals which allowed dental analysis (in the other 3 individuals which presented postaxial pathologies, the mouth and the dental pieces where not preserved): individuals from the context 67, 727, 755, 1337 and 2247. As we can see in the Chart 4.8, the presence of these defects in the tooth enamel were always recorded in the frontal area (mandible and maxilla, always incisives and canines), except in the case of the context 67, in which also both mandibular first premolars where affected.

Plate 4.4 offers a good example of this condition documented in one of Ille Cave individuals.

- **4.3.5. Teeth wear: attrition and abrasion.**

Among all the individuals in whom dental study was carried on, can be observed that all of them presented really similar wear patterns. The consequences of the attrition process (natural teeth wear caused by the continuous contact and friction between the teeth during the masticatory process and the chemical affection of them caused the mixture of the food residues with the saliva and mouth mucosa) in Ille Cave prehistoric population showed exposition of the dentine in almost all the teeth. For understanding better the possible groups of individuals associated to the different stages of occlusal wear, was committed an study based in a reference scoring system (BUIKSTRA, UBELAKER, 1994, pp.52-53), which results follow in Chart 4.9.

Chart 4.8. DISTRIBUTION OF DEH IN THE DENTITION OF THE INDIVIDUALS OF ILLE CAVE WICH PRESENTED THE PATHOLOGY.

CONTEXT NUMBER: 67

- SEX: ♂
- AGE: *Young adult*

	Right Side				Left Side			
MAX	PM1	C	I2	I1	I1	I2	C	PM1
	-	-	**X**	**X**	**X**	**X**	-	-
MAN	**X**	**X**	-	-	-	-	**X**	**X**
	PM1	C	I2	I1	I1	I2	C	PM1
	Right Side				Left Side			

CONTEXT NUMBER: 727

- SEX: ♀*?*
- AGE: *Middle adult*

	Right Side				Left Side			
MAX	PM1	C	I2	I1	I1	I2	C	PM1
	-	**X**	-	-	-	-	**X**	-
MAN	-	**X**	-	**X**	**X**	**X**	**X**	-
	PM1	C	I2	I1	I1	I2	C	PM1
	Right Side				Left Side			

CONTEXT NUMBER: 755

- SEX: ♂*?*
- AGE: *Young adult*

	Right Side				Left Side			
MAX	PM1	C	I2	I1	I1	I2	C	PM1
	-	-	-	-	-	-	-	-
MAN	-	**X**	-	-	-	-	-	-
	PM1	C	I2	I1	I1	I2	C	PM1
	Right Side				Left Side			

CONTEXT NUMBER: 1337

- SEX: ♀*?*
- AGE: *Middle adult*

	Right Side				Left Side			
MAX	PM1	C	I2	I1	I1	I2	C	PM1
	-	**X**	**X**	-	**X**	-	**X**	-
MAN	-	**X**	**X**	**X**	**X**	-	**X**	-
	PM1	C	I2	I1	I1	I2	C	PM1
	Right Side				Left Side			

CONTEXT NUMBER: 2247

- SEX: ♂
- AGE: *Young-middle adult*

	Right Side				Left Side			
MAX	PM1	C	I2	I1	I1	I2	C	PM1
	-	-	-	**X**	**X**	-	-	-
MAN	-	-	-	-	-	-	**X**	-
	PM1	C	I2	I1	I1	I2	C	PM1
	Right Side				Left Side			

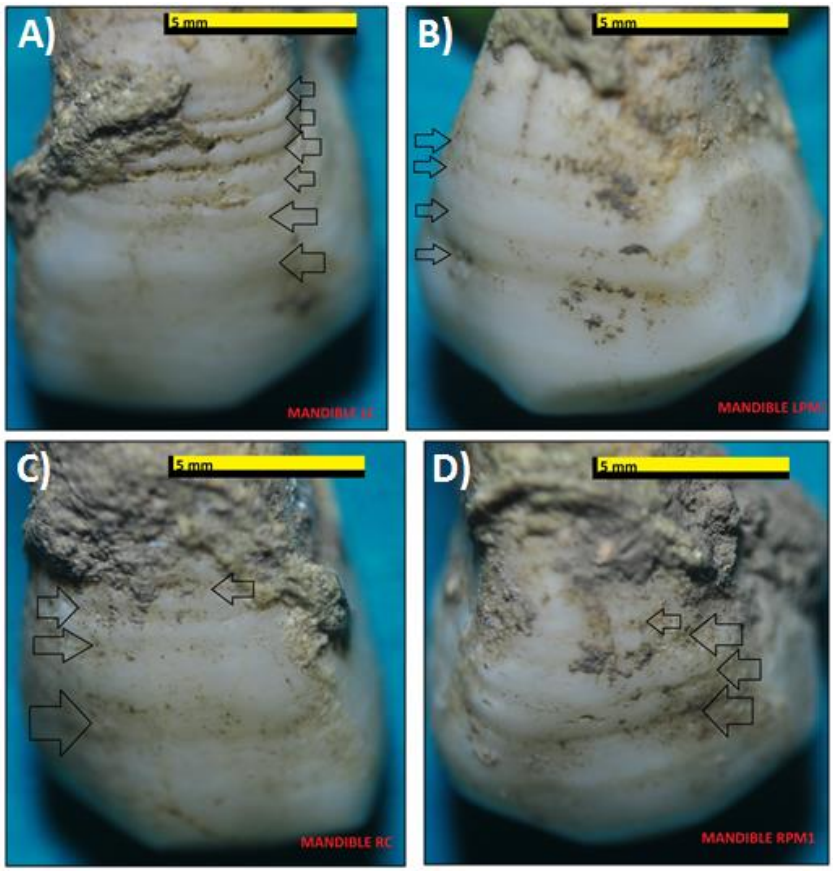


PLATE 4.4. A good example of the dental enamel hypoplasia in Ille Cave is the one presented in these images of the mandibular teeth of the individual from context 67. We can observe the DEH typical linear grooves marked with black arrows. A) LC, B) LPM1, C) RC, D) RPM1.

The teeth assemblage studied presents normally and advanced status of teeth wear: half part of the cases present large dentine areas with a surrounding enamel ring in the frontal teeth (including premolars) occlusal surfaces, even some times giving the teeth a "shovel" aspect; meanwhile, more than a quarter part of the surfaces of each molar quadrants exhibit dentine in isolated islands, even in concave shapes, although the occlusal surface is still surrounded by an enamel ring. Plate 4.5 shows examples of all the different status of wear documented in Ille.

If taken in account that the individual from context 727 presents a case of unusual wear pattern (ROBERTS, MANCHESTER, 2010, pp.205) related to a specific non-masticatory habit in the molars (Chapter 5), could perfectly fit in this group wear patterns. Also, two unusual wear patterns were documented in the frontal mandibular teeth of the individuals from contexts 755 and 2247, which we will explain in the discussion of Chapter 5.

The first of the unusual wear pattern (Plate 4.6) was documented in the frontal teeth (incisives and canines) of the mandible of two of the individuals (context 755 and 2247): all the referred dental pieces showed a pattern of wear in oblique sense, in lingual-labial direction, giving the surface of the enamel a smooth aspect which followed a rounded shape (not flat, like in cases of advanced states of attrition or malocclusion).

In the case of the skeleton from context 2247, other interesting markers where registered during the microscopical analysis (Plate 4.7):

- Longitudinal microrotures of the enamel of an incisor (RI2), in a vertical sense of the lingual surface.
- Microscopical grooving pattern over the occlusal surface of the incisors (particularly in LI1 and LI2), all of them linear and in vertical direction.

These markers confirm the presence of a constant strength supported by the frontal teeth, strength which would follow a lingual-labial direction, with a vertical component which would go from up to down (which would explain both the direction of the grooves and the vertical disposition of the shelling in RI2).

The second unusual wear pattern which we registered in the Ille Cave osteological assemblage was the one of the mandibular molars of context 727 (middle adult individual, probable female). While the rest of the teeth of this individual shows normal patterns of erosion caused by attrition (occlusal surfaces), the molars of both sides of the mandible showed a concave wear pattern in lingual-buccal direction: scoped dentine, weared to almost a short of chisel shape, as can be appreciated in Plate 4.8. This particular form of erosion, together with the fact that both third molars where completely flat-weared to the roots (what is kind of strange if we take in account the fact than the third molar is the last one in erupt: then, why is more weared than M1 and M2?), as well as that the damages over the enamel and dentine presented a more advanced status in the right side of the mouth (asymmetrical), allowed us to discount any natural reasons (attrition, malocclusion) or parafunctional habit (like the bruxism/teeth grinding), so this particular case could point to the use of the molar region in some kind of cultural habit or activity, as will be analyzed in Chapter 5.

Chart 4.9. OCCLUSAL SURFACE WEAR SCORING RESULTS OF ILLE CAVE INDIVIDUALS (BASED ON BUIKSTRA, UBELAKER, 1994).

**Notice that this scoring system goes from 1 (really light wear pattern) to 10 (really strong).*

CONTEXT Nº.	STAGES OF WEAR (1-10) AND DESCRIPTIONS			STATUS
	Incisors/Canines	**Premolars**	**Molars**	
67	1 *Polished (no dentine exposure)*	1 *Polished (no dentine exposure)*	2 *Wear facets invisible or very small*	**VERY LIGHT**
755	- *Not observable (frontal teeth altered by activity pattern)*	- *Not observable (frontal teeth altered by activity pattern)*	4 *Flat surface, shadows of imminent dentine exposure*	**LIGHT**
2247	- *Not observable (frontal teeth altered by activity pattern)*	- *Not observable (frontal teeth altered by activity pattern)*	4 *Flat surface, shadows of imminent dentine exposure*	**LIGHT**
800	4-5 *Large dentine exposed area with complete enamel ring*	4-5 *One or two large dentine areas exposed*	5-6 *More than ¼ of the quadrant exhibits dentine, enamel outer ring present*	**ADVANCED**
907	4-5 *Large dentine exposed area with complete enamel ring*	4-5 *One or two large dentine areas exposed*	5-6 *More than ¼ of the quadrant exhibits dentine, enamel outer ring present*	**ADVANCED**
1337	4-5 *Large dentine exposed area with complete enamel ring*	4-5 *One or two large dentine areas exposed*	5-6 *More than ¼ of the quadrant exhibits dentine, enamel outer ring present*	**ADVANCED**
1825	4-5 *Large dentine exposed area with complete enamel ring*	4-5 *One or two large dentine areas exposed*	5-6 *More than ¼ of the quadrant exhibits dentine, enamel outer ring present*	**ADVANCED**
727	4-5 *Large dentine exposed area with complete enamel ring*	4-5 *One or two large dentine areas exposed*	9 *Severe loss of crown height, wear almost till the roots*	**VERY ADVANCED**

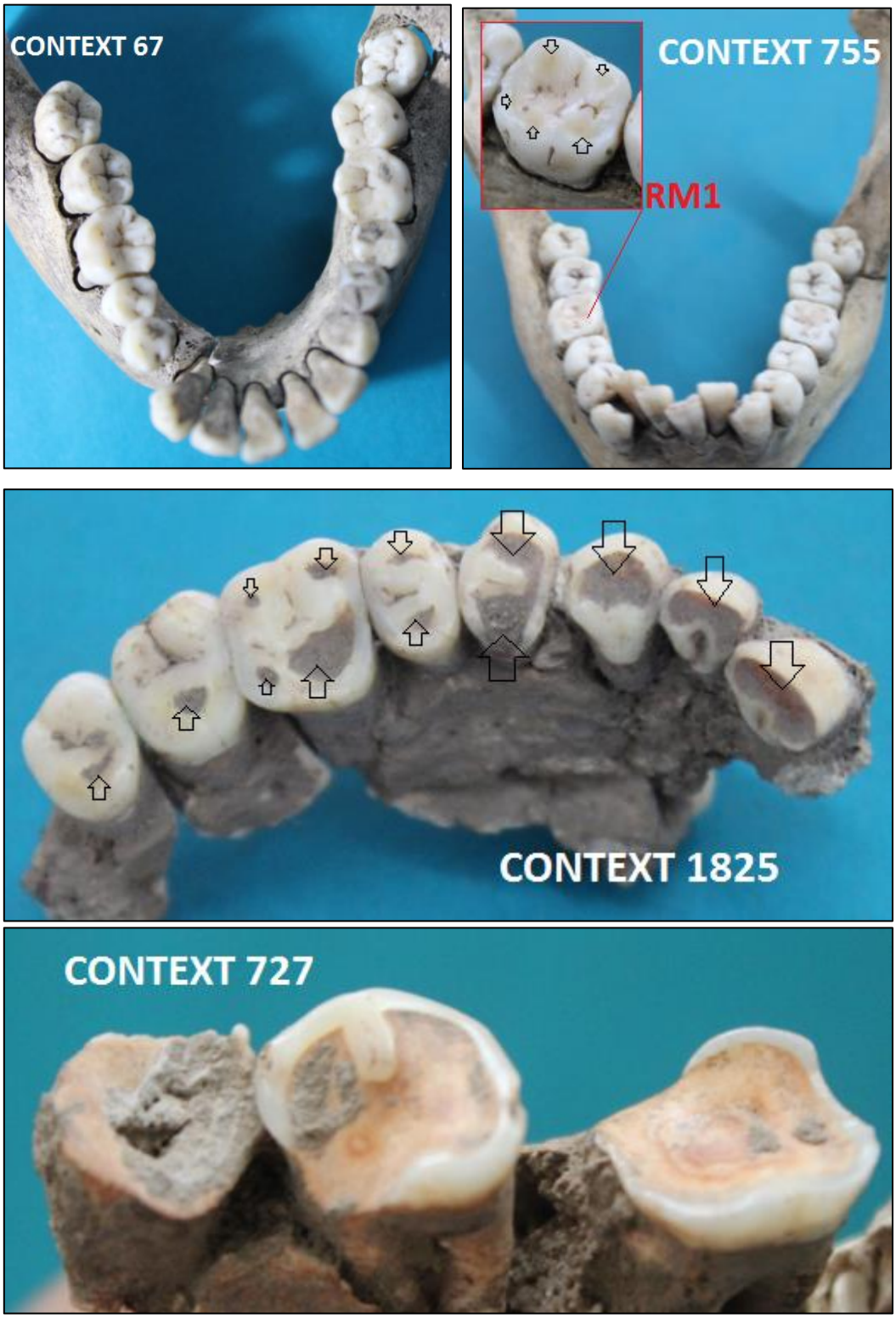


PLATE 4.5. Examples of the different levels of teeth wear registered in the assemblage: very light wear (context 67, mandible), light wear (context 755, mandible), advanced (context 1825, maxilla) and very advanced (context 727, mandible).

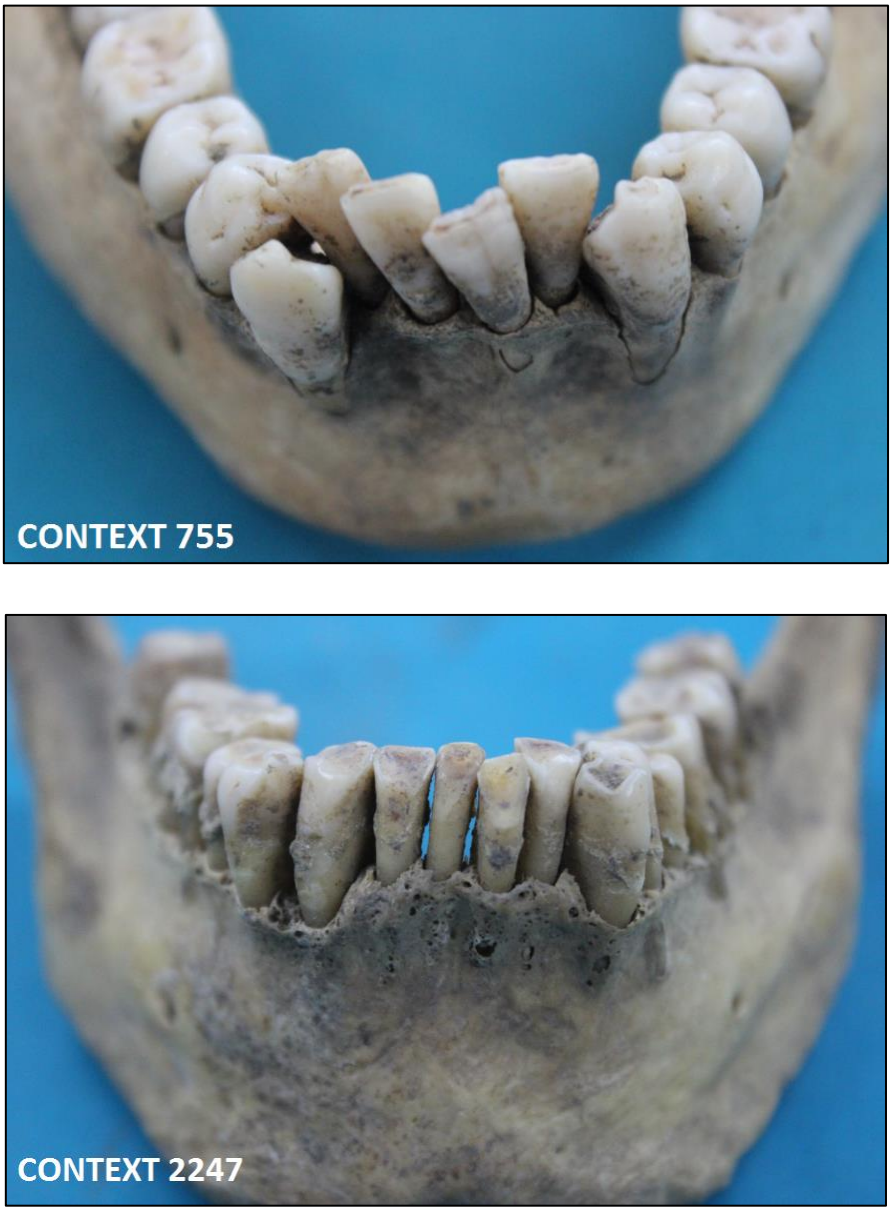


PLATE 4.6. Unusual wear pattern in the frontal teeth of the mandibles of the skeletal remains recovered in the context 755 and 2247. We can observe the lingual-labial oblique pattern of the erosion, especially noticeable in the case of 2247, and the rounded surfaces of the labial surfaces.

PLATE 4.7. Other microscopical markers of the studied unusual wear pattern in individual from the context 2247. In the left picture, we can observe two vertical microrotures. In the right side, longitudinal grooves caused by abrasion.

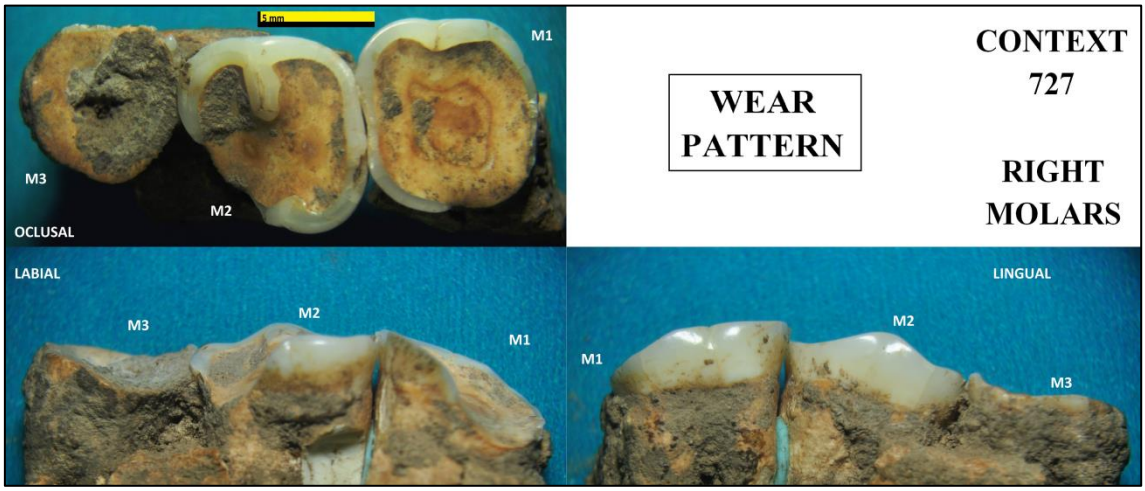


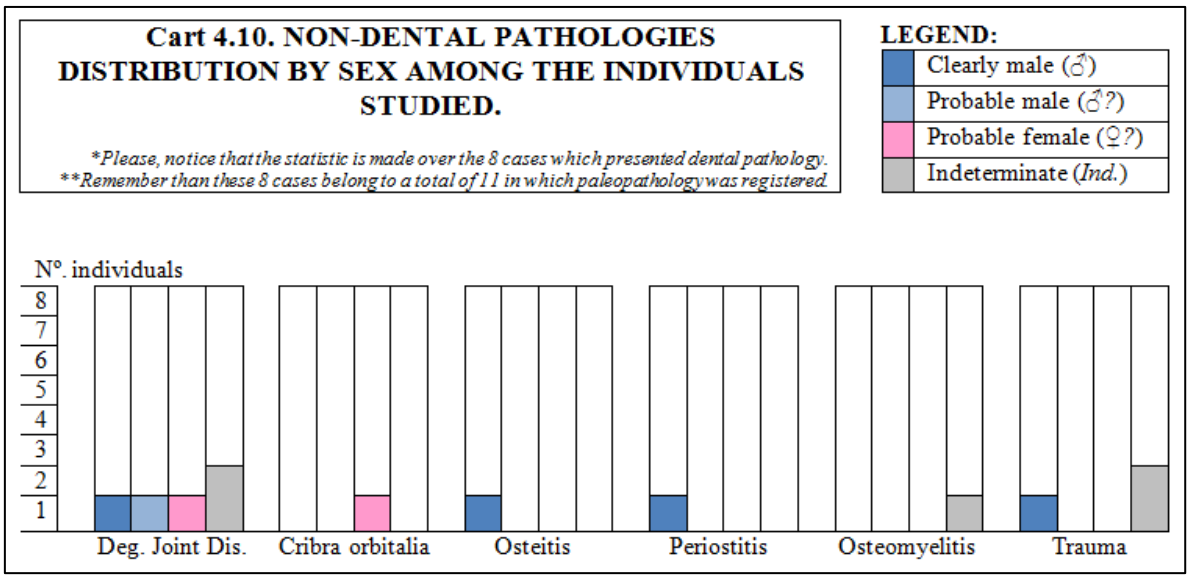
PLATE 4.8. Another unusual wear pattern displayed in the right molar pieces of the mandible of the skeleton from context 727. We can observe the oblique pattern, specially representative in lingual-buccal direction, as well as the advanced stage of teeth wear.

4.4. NON-DENTAL PATHOLOGY.

Speaking about non-dental pathologies, again 8 of the 11 cases in which we registered signs of disease presented this variety, which corresponds to several types of illness (healed trauma, degenerative joint disease, infections and metabolic disease): the individuals from the contexts 484, 703, 727, 755, 800, 1825, 2240 and 2247.

Also in a similar way to the exposed for the dental pathologies (*vide supra*: 4.3), the problematic of the non-definite sex and age diagnosis of some individuals won´t allow

us to refer any comparative study about the presence of these pathologies by gender, nor age. In any case, the corresponding statistical chart of pathological conditions distributed by sex follows (Chart 4.10).



- **4.4.1. Metabolic diseases. Cribra orbitalia.**

In the case of the skeleton coming from the context 800 (young adult, probable female), we could notice an area of porosity associated with a process of bone remodeling in the roof of its right ocular orbit (unfortunately the left one is missing, so we couldn´t determine if it would appear in both sides). After discarding the fact that the porosity could be result of postdepositional factors, and since in this case the reactive bone process confirmed the pathological condition, a case of cribra orbitalia could be diagnosed, pathology normally present in the archaeological skeletal register of ancient populations, really interesting from the perspective of the dietary studies: the affection of the bone in the orbit roofs is normally the result of the hyperplasia of the diploë, the spongy bone structure between the compact bone surfaces of the flat bones present in the orbits (WALKER *et al.*, 2009, pp.109; ROBERTS, MANCHESTER, 2010, pp.546).

The presence of cribra orbitalia is often diagnosed through several markers which tend to characterize it (NAVEED *et al.*, 2012, pp.394): the reduction of the cortical bone density in the orbital roof, an increased granularity in the medullary layer of the bone surface, a representative thickening of the orbital roof in several cases (especially in advanced states of the condition) and an increase in the middle table of bone (possibly to approach trough X-Ray tests) are the four characteristics which use to be present.

Several states had been identified in the progress of this pathology (NAVEED *et al.*, 2012, pp.395), as shown in Plate 4.9:

- Grade 0: normal bone surface.
- Grade 1: capillary-like impressions in the bone surface.
- Grade 2: scattered fine foramina in the bone surface.
- Grade 3: large and small isolated foramina in the bone surface.
- Grade 4: foramina with trabecular involvement phase of remodeling (typical in adult individuals, since the pathology is more evident in subadults).
- Grades 5-6: presence of partial destruction of the roof of the orbit.

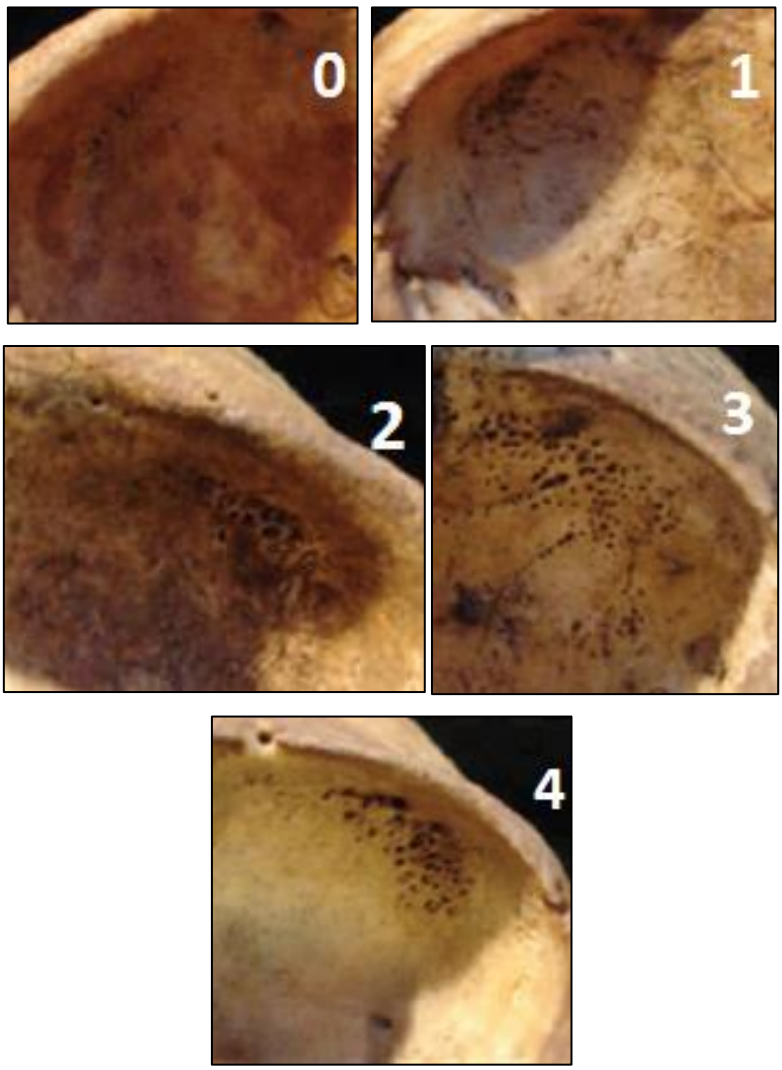


PLATE 4.9. Stuart-Macadam defined grades of progression of cribra orbitalia (grades 0-4), as explained in the main text: *vid supra* (From: NAVEED *et al.*, 2012, pp.395).

In the case of context 800 (Plate 4.10), we could observe remodeling in the several foramina present in the roof of the orbit, so we could determine a Grade 4, what is logical following the previous pattern if we take in account that the individual is a young adult: the disease affected the individual during early vital phases, but the arrival to adulthood and a possible access to a better diet, together with a stronger organism, made easier the healing process.

PLATE 4.10. Signs of metabolic disease (*cribra orbitalia*) in the right orbit roof of the individual 800 from Ille Cave.

- **4.4.2. Degenerative joint diseases. Osteoarthritis and Schmorl´s nodes.**

Several degenerative conditions which affected the joints of some individuals where documented during the laboratorial analysis of the assemblage.

The first of these conditions was spinal osteoarthritis. This pathology is associated with the presence physical stress in the area (ROBERTS, MANCHESTER, 2010, pp.340-341), which variates in every point of the spine (since it´s curved, not completely vertical), so that the variation of frequency of the pathology does as well.

Three main components are normally present in the development of osteoarthritis, which presence allowed the determination of the pathology in the studied assemblage (ORTNER, 2011, pp.546): first, the breakdown of the articular cartilage, which would lead to the contact and abrasion between bone surfaces; second, the formation of reactive bone, mainly in the subchondral compact and trabecular bone; and third, the consequent growth of new cartilage and bone in the margins of the joint.

As the result of this process, three markers can be generally observed in the bones affected by this condition: marginal lipping, as the result of the new bone formation (example in Plate 4.11); eburnated surfaces, as the result of the contact and abrasion

between bone surfaces after the cartilage loss; and osteophytes and bonny plaques (example in Plate 4.12), also a result of the creation of new tissue (ORTNER, 2011, pp.546; AUFDERHEIDE, RODRÍGUEZ-MARTÍN, 1998, pp.96). These characteristics where documented in two individuals of the assemblage studies: the ones from contexts 727 (middle adult, probable female) and 2247 (male young-middle adult), as illustrated in Chart 4.11. Unfortunately, no signs of eburnation where documented in any case, but this fact was attributed to the poor preservation status of the column in both individuals.

Chart 4.11. LOCATION OF OSTEOARTHRITIS MARKERS IN THE INDIVIDUALS FROM CONTEXTS 727 AND 2247 OF ILLE CAVE.

MARKERS	CONTEXT 727	CONTEXT 2247
Osteophytes and bonny plaques	Superior and inferior surfaces of the vertebral bodies in cervical, thoracic and lumbar areas (not specific vertebrae).	Superior and inferior surfaces of the vertebral bodies of C3-4, T10-12 and L3.
Marginal lipping	Superior and inferior edges of the vertebral discs in thoracic and lumbar areas (not specific vertebrae).	Superior and inferior edges of the vertebral discs of C3-4, T4-12 and L1-5.
Eburnation	(Not observed)	(Not observed)

PLATE 4.11. Lateral view of the last lumbar vertebrae (L2-L5) of the individual from context 2247 of Ille Cave, in anatomical position. We can observe the marginal lipping in the frontal aspect of all the vertebral bodies, both in the upper and inferior edges.

PLATE 4.12. Superior view of a vertebral body of the cervical area of the individual from the context 727 of Ille Cave, in which we can observe the formation of new bone trough the presence of an osteophyte near to its posterior edge.

The second joint disease marker which was noticed in the vertebral column of the studied assemblage was the presence of Schmorl´s nodes (Plate 4.13), in this case in the last lumbar (L8-12) vertebrae and the first thoracic vertebra of the individual from context 484 (an adult of indeterminate sex), and again in all the five lumbar vertebrae of the individual from context 2247 (which had also signs of osteoarthritis, as already discussed). This kind of nodes, which appear as concavities in the superior and/or inferior surfaces of the vertebral bodies, normally rounded or oval-shaped, are symptom of an hernia: the inflammation of the intervertebral bodies makes the cartilage to expand inside the adjacent vertebral bodies, causing the depressions observed (AUFDERHEIDE, RODRÍGUEZ-MARTÍN, 1998, pp.96-97; PENG *et al.*, 2003, pp.879).

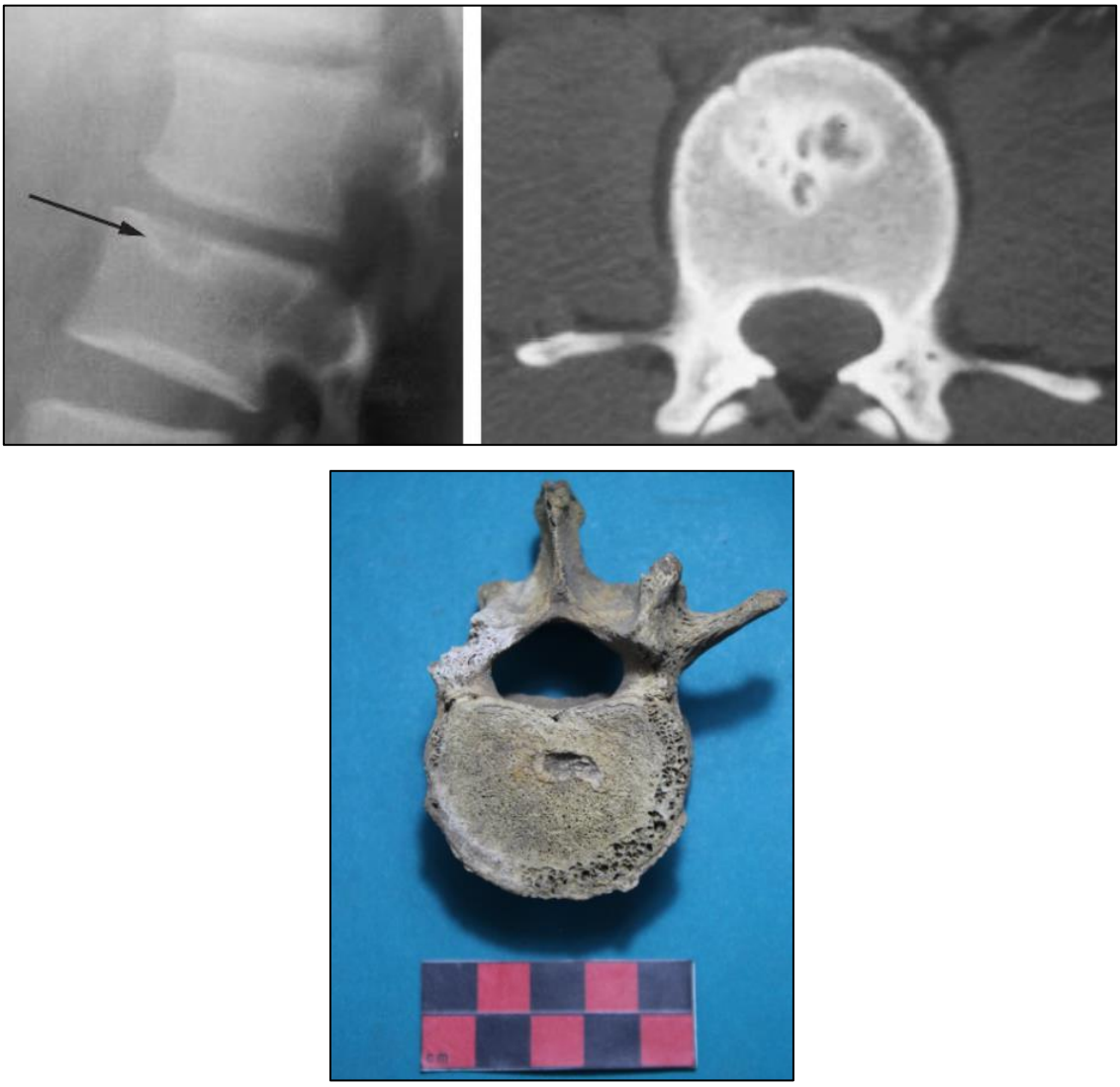


PLATE 4.13. Superior: Examples of X-Ray analysis overcome in live patients which display the Schmorl´s nodes (PENG *et al.*, 2003, pp.880). Inferior: node registered in in the upper vertebral body of L2, individual from context 2247 of Ille (notice also the marginal lipping in the frontal edge).

Other signs of non-specific degenerative joint diseases where recorded in Ille Cave assemblage (please, refer to Annex III), again in the vertebrae (cases of marginal lipping in cervical vertebrae of the individuals from contexts 755 and 2240), but also in other anatomical regions: the left elbow of the individual from context 2240 (guiding ridge of the ulna), and also the shoulder joint (clavicle and scapulae) of the individual from context 2247.

- **4.4.3. Infectious diseases. Osteomyelitis, periostitis and osteitis.**

Three different varieties of infectious diseases were also registered in the study phase of the selected assemblage of prehistoric individuals from Ille:

- Context 703 (adult of indeterminate sex): osteomyelitis in forearms (ulna and radius) and legs (tibia and fibula).
- Context 2247 (masculine young-middle adult): periostitis in legs and arms; also, osteitis in pubis and sacroiliac joint.

The osteomyelitis is an infectious disease which normally starts with the introduction of pyogenic bacteria in the bone tissue, normally *staphylococcus* aureus, although other agents (virus, fungus, parasite) can also cause the genesis of this condition (BAPTISTA, TARDIVO, 2012, pp.6; ORTNER, 2011, pp.181; ROBERTS, MANCHESTER, 2010, pp.408-409). If the infection spreads through the cortex and/or the periosteum, the case would be recognized as secondary osteomyelitis; meanwhile, once the infection affects the medullary cavity, the pathology would manifest in its strongest modality.

The creation of pus inside the medullary cavity makes the diaphysis of the bone support and stress, which naturally results in the creation of round-shaped openings in its surface (cloacae or fistulae), which would allow the drainage of it to the exterior (ORTNER, 2011, pp.182-184; WHITE, FOLKENS, 2005, pp.318). Also, the pus can produce the elevation of the periosteum of the bone, and as well the creation of new bone surrounding the original bone cortex: the involucrum or sequestrum (ORTNER, 2011, pp.182-186; WHITE, FOLKENS, 2005, pp.318), which would give the bone a deformed shape.

The individual recovered in the context 703 of Ille Cave, an adult which sex could not be determined, clearly showed this pathological condition (Plate 4.14), since both cloacae and involucrum could be noticed in both forearms (ulna x2 and radius x1) and down legs (tibia x2 and fibula x1).

The next pathological condition documented was the periostitis, although is important to explain here that it´s not considered as a disease by itself (WHITE, FOLKENS, 2005, pp.318): periostitis is a term normally used to define the inflammatory process of the periosteum of the bone (normally long bones), and which can be a consequence of multiple factors (both traumatic or infectious).

The origin of the periostitis comes normally from the formation of microtraumatisms wich appear in the periostium of the long bones in the legs, caused by locomotor intense activities (for example, intense running: the vibrations caused for the constant impact of the limbs in the floor can be one factor wich could cause the microrotures). This microrotures will be the focus from where the infection will expand *a posteriori*. As a consequence of this, the periosteum supports the surface formation of new lamellar bone, normally following an organized striated pattern in parallel lines (ORTNER, 2011, pp.206-207; ROBERTS, MANCHESTER, 2010, pp.417-418): this pattern allows the differential diagnosis, like happened in the only case registered in Ille Cave, the individual from context 2247 (a male young-middle adult), as can be noticed in Plate 4.15. Is interesting that the distribution of this new bone formations affects specially to the inferior limbs of the individual, and even more in the case of the tibia, another evidence for the diagnosis, since normally this kind of infectious disease manifest stronger in the tibial diaphysis (ROBERTS, MANCHESTER, 2010, pp.417).

But, overall this conditions, the same individual also presented a case of pubic osteitis, the third infectious manifestation registered in the assemblage. While the terms osteomyelitis or periostitis offer more defined descriptions for particular conditions, the term osteitis has worked in the bibliography as a more general term for the "inflammation of bone tissue caused by infection or injury and which is not specific as to cause" (as in WHITE, FOLKENS, 2005, pp.317).

The pubic osteitis is frequent in sportive people, especially in cases of people which make a lot of exercise with the down limbs (MAJOR, HELMS, 1997, pp.711-712; GABARRÓ *et al.*, 2008, pp.346), what would fit well with the case of periostitis determined for individual from context 2247. Normally the intense changes of rhythm during the locomotion, such as abrupt accelerations or decelerations, climbing activities or kick movements, are the detonation facts for the spread of the infection (MAJOR, HELMS, 1997, pp.712; GABARRÓ *et al.*, 2008, pp.346). This high intensity of the activity makes the pubic area suffer quite big stress situations (Plate 4.16): the strong abdominal efforts can create micro-traumatisms, which would be the focus of the immediate infection, being *pseudomonas aeuriginosa* the most recurrent bacteria (GABARRÓ *et al.*, 2008, pp.346).

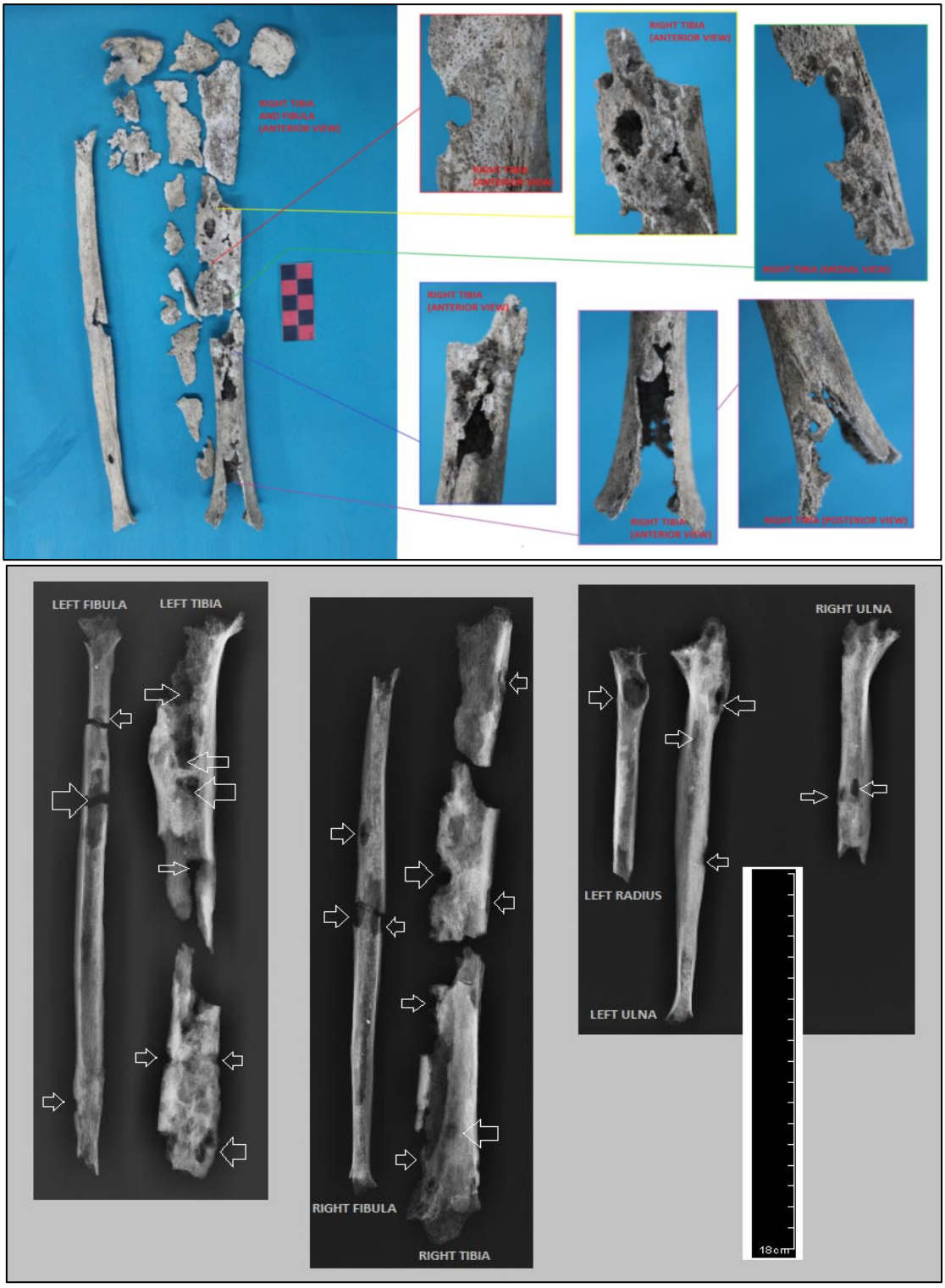


PLATE 4.14. Superior: detailed pictures of the cloacae and involucrum registered over the left tibia and fibula of the skeleton from the context 703 (for the rest of the limbs, please, refer to Annex III). Inferior: cloacae observed during the X-Ray analysis of the bones which presented the condition.

PLATE 4.15. Image wich exemplifies the areas affected by periostitis in the right femur of the individual 2247 of Ille (anterior view), with the caracteristical pattern of new lamellar bone formation. For more images of other areas affected, please, refer to the paleopathological files (Annex III).

In advances states of the pubic osteitis, the loss over the pubic symphysis outline is quite evident, like in this case of study from Ille Cave, and also the symptoms can extend to the sacroiliac joint (GABARRÓ *et al.*, 2008, pp.347; MAJOR, HELMS, 1997, pp.712-717): in the same case could be noticed reactive bone and marginal lipping in both sides of the articulations of the pelvic griddle with the sacrum.

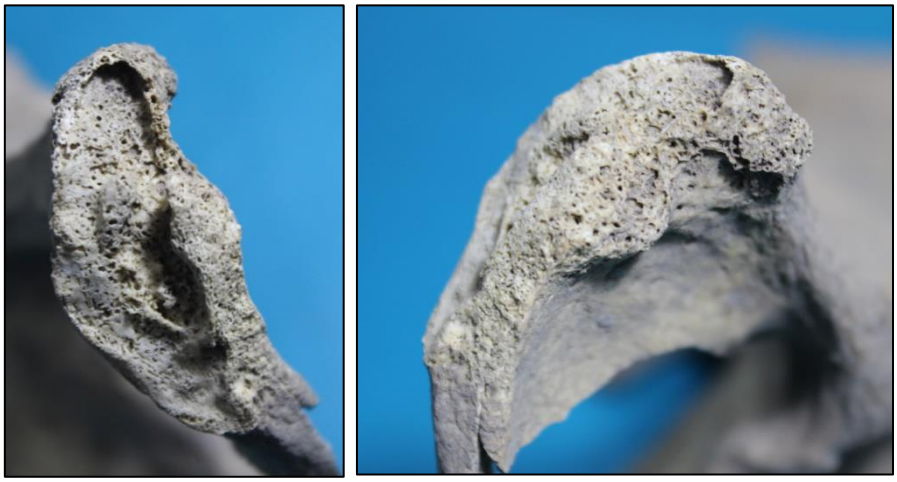


PLATE 4.16. Detailed pictures of the pubic symphisis of the individual from the context 2247, in wich we can observe the degeneration of the bone surface and the complementary growth of new bone.

- **4.4.4. Trauma. *Ante mortem* fractures.**

Beneath all the individuals registered in Ille Cave which presented pathological conditions, also three different cases of trauma where registered:

- Context 2247 (masculine young-middle adult): lateral healed fracture of the right nasal bone.
- Context 1825 (young adult, indeterminate sex): healed oblique fracture of the left femur.
- Context 484 (adult, indeterminate sex): healed traumatism in the thorax with costovertebral involvement (right side).

About the case of the nasal fracture in the individual recovered from the context 2247 of Ille Cave (Plate 4.17), the differential diagnosis was committed (for distinguish it from possible morphological anomalies) attending to different aspects normally used in this cases (as in LESSA, MENDOÇA DE SOUZA, 2006, pp.134): "formation of new bone, absence of bone, bone resorption, interruptions or breaks in anatomical structures, cortical healing indicated by high-density areas, active resorption indicated by porotic areas associated with bone loss, and fissures and depressions that might indicate

morphological change associated with trauma". In this sense, the fact that the individual from Ille presented some of these aspects would point to a clear case of nasal traumatism:

- The presence of fracture lines and dislocation: easy to notice in the surface of the nasal bones, since no callus covered them (except possibly in the superior limit between both nasal bones). We could notice that the right nasal bone suffered a horizontal fracture, possibly as a product of a lateral impact, and that the inferior part of it also suffered a dislocation.
- The fact that the fracture lines healed in a misaligned position: the dislocated fragment healed in a misaligned position, as we can observe in the presence of empty spaces (inferior part of the connection between the fragment and the maxilla) and the irregular surface of connection between both nasals. This unaligned healing is frequent in this cases of nasal fracture, in which "the fragments can rarely be reduced to the original position or stabilized, thus resulting in badly aligned healing, with aesthetic and functional consequences" (LESSA, MENDOÇA DE SOUZA, 2006, pp.134).
- Possible absence of bony microfragments in the areas described, which could be consequence of the reabsorption or expulsion of them by the organism.
- The septum seemed deviated, although this could be a consequence of postdepositional process.

The second case of traumatism that which was documented in Ille assemblage was the healed oblique femoral shaft fracture in the left down limb of the individual from context 1825 (WHITE, BLACK, FOLKENS, 2012, pp.434; ROBERTS, MANCHESTER, 2010, pp.226-227). The healed fracture was registered on the midshaft of the bone, as can be observed in Plate 4.18, but we couldn´t determine the presence of any callus, what together with the formation of lamellar/woven bone, which was already being replaced in some areas with trabecular bone, make thought that the process of fracture repair was in the an advanced phase, the remodeling stage (ROBERTS, MANCHESTER, 2010, pp.232-234).

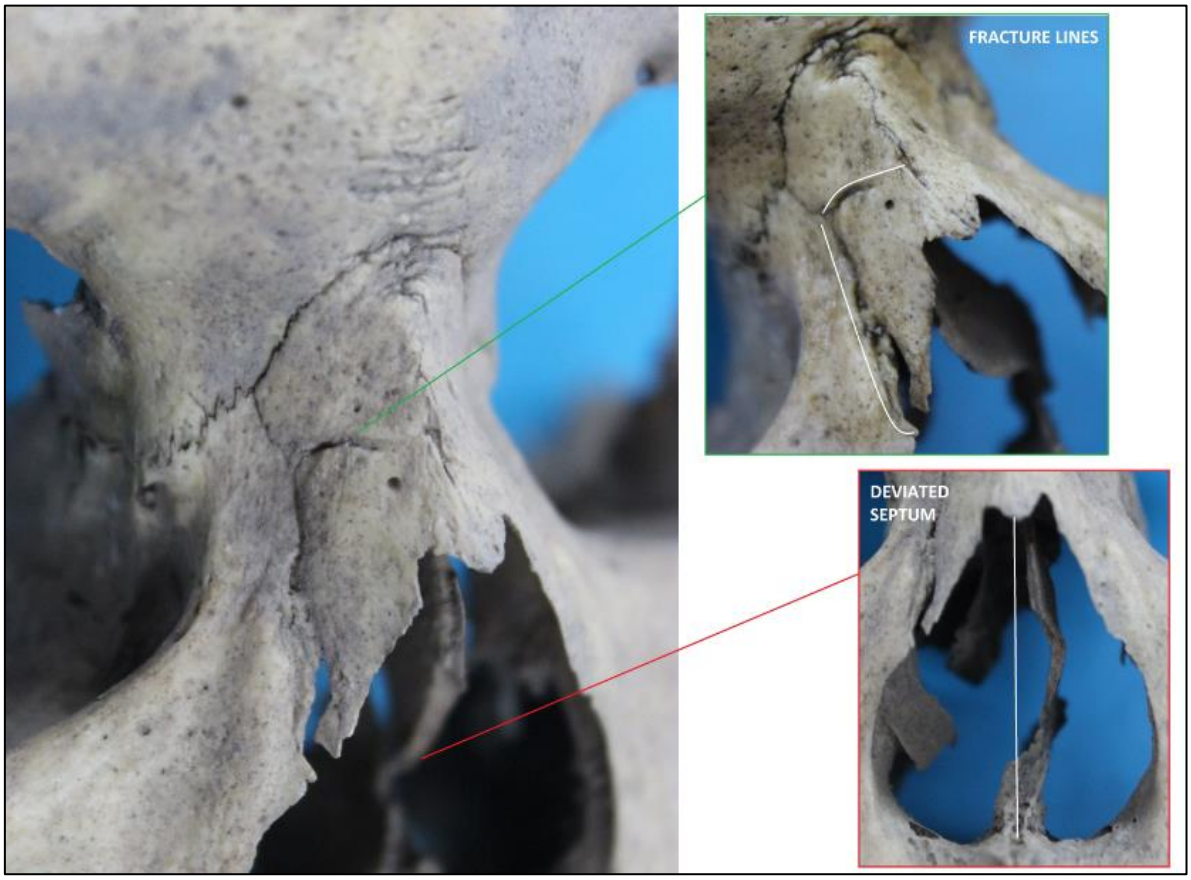


PLATE 4.17. Right nasal fracture of the individual from context 2247 from Ille Cave. We can notice in the images the misaligned healed fracture lines, and also de deviation of the septum.

Also, a modern fracture, possible result of the excavation process, crossed perpendicular to the healed fracture, that allowed to confirm again that the fracture was oblique and that it didn't repair in its original aligned position, but in a lateral superposition between both broken ends (both medullary cavities appear in a parallel position in the visible cross section), possibly as a result of the muscular spams following the stress, which would have pulled the broken end past each other (WEBB, 1995, pp.196).

The X-Ray analysis allowed proving the overlapping between both femoral fragments, which carried the posterior misaligned fracture (Plate 4.18).

PLATE 4.18. Anterior (left picture) and posterior (right) views of the left femur of the individual, in which we can appreciate the healed oblique fracture in the medial diaphysis, which was repaired in a misaligned position. In the X-Ray vision (anterior), the overlapping of fragments seems more visible (marked with white arrows).

Finally, the individual retrieved from context 484 presented a case of costovertebral trauma, which implied the dislocation of the ribs of the right side of the thorax (from 2nd to 8th), and which started a healing process without being reinserted in their original position, as can be appreciated in Plate 4.19. Since the rest of the thorax is not preserved, but the scapula from the same side doesn´t present any sign of pathological condition (what could point to a vertical direction of the strength which caused the trauma), could be the result of a big strength projected over the back of the individual, which dislocated the ribs (some examples of possible causes would be: fall back from a considerable height, or over a hard surface, the impact of a heavy object falling over the back of the individual, etc).

The individual survived, at least, enough time for the ossification process to start (Plate 4.20): even if the ribs where not fused, the bone reacted creating new cortical surfaces, which adapted their shape to the spaces left between the contiguous ribs and other organs. Possibly, the infectious signs observed over the vertebrae, and which are especially visible in the right side (same side in which the trauma is present), are a direct consequence of the trauma.

PLATE 4.19. Proposal of reassembly of vertebrae and ribs of the individual from context 484, which displays the original position of the ribs during the bone alterations suffered after the trauma.

RIB Nº.	RIB HEAD – EXTERNAL VIEW	RIB HEAD – INTERIOR VIEW
3rd		
4th		
5th		
6th		
7th		
8th		
9th		

PLATE 4.20. External and internal view of the heads of the ribs from 3rd to 9th of the individual from context 484 of Ille Cave. The altered morphology, as a result of the process of bone remodeling, can be observed in every case, in the shape of flat projections, concavities (5th, 9th) and osteophytes (6th , for example).

- **4.4.5. Activity related stress markers.**

In the case of the individual recovered in context 2247 (masculine young-middle adult), also some interesting signs of occupational stress markers where registered in the shoulder articulation bones: new bone was growing in both scapulae, in the acromion process of both bone (Plate 4.21); but new bone was specially evident in both clavicles, over the ligament insertion areas (conoid and costoclavicular ligaments), and also arround the attachment of the deloid muscle (as shown in Plate 4.22).

The literature (LAI, LOVELL, 1992, pp.224-226) refers to this cases as markers of ocupational stress asociated with labours wich imply the reiterative movement of the shouders, such as the ones asociated with the typical circular movement in rowers, or in activities sich as carring, lifting and padding. (in the case of Ille Cave, since the sea is not inmediate to the site, we can point to these other activities). The hypertrophy of these muscles requires a compensation from the bone, wich creates this new bone arround the inserction areas for developeing a stronger conection with the muscle.

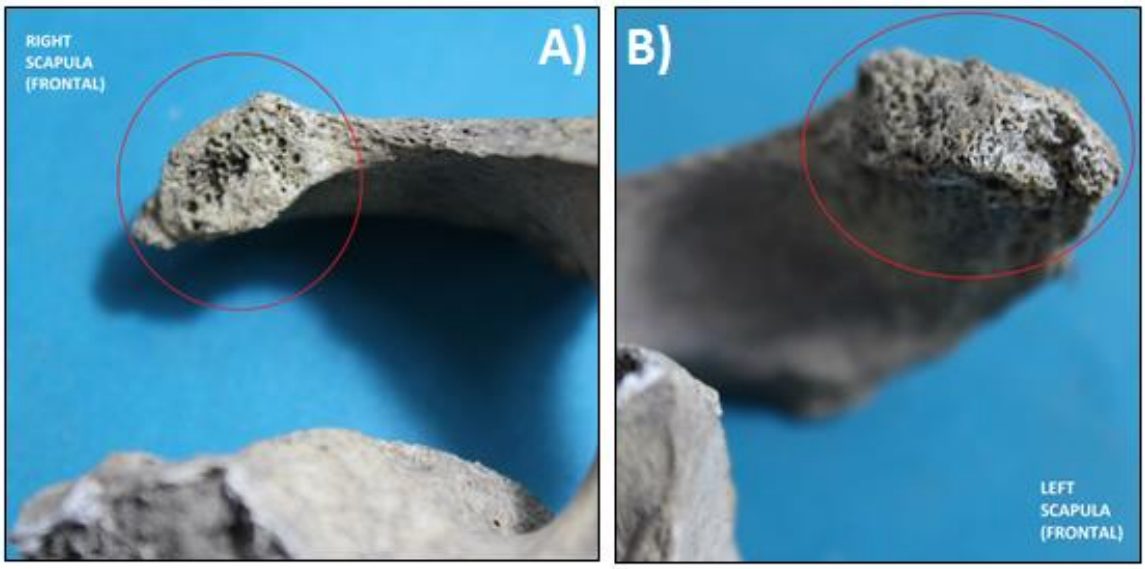


PLATE 4.21. New bone formation over the acromion process of both right (A) and left (B) scapulae in our individual.

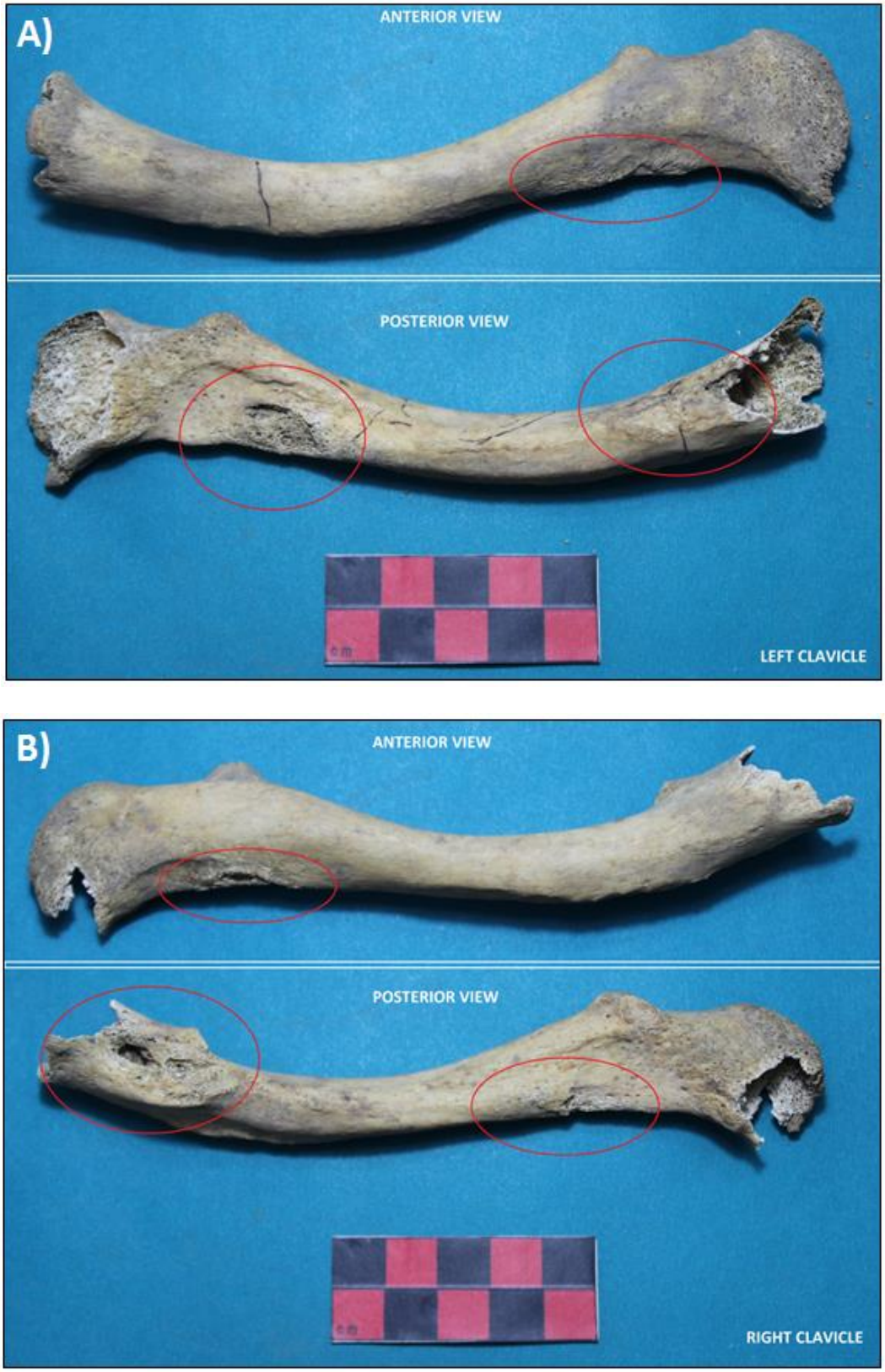


PLATE 4.22. Signs of new bone formation over both left (A) and right (B) clavicles of the individual from context 2447.

5. INTERPRETING THE DATA COLLECTED: FINAL DISCUSSION AND FUTURE PERSPECTIVES.

5.1. INTERPRETATION AND CONTEXT OF ILLE CAVE PATHOLOGIES IN A GENERAL FRAMEWORK OF SOUTHEAST ASIAN BIOARCHAEOLOGY.

This chapter will focus on developing explanations referred to the pathologies registered in Ille Cave prehistoric population, already presented in Chapter 4 as the results of the analysis. The establishment of interpretative models will be presented for some particular pathologies which would require a deeper explanation that the ones referred previously, since in Chapter 4 just descriptive approach was accomplished. Some of these cases are the unusual teeth wear patterns registered in the assemblage (section 5.2.4), which were studied in order to understand their causes, with positive results: some interesting notes about the activities developed by these prehistoric societies could be inferred from them. Also, other diseases such as the healed traumatisms present in the assemblage (section 5.1.8) would lead the reader trough ideas about the accidental origins of the paleopathologies in Ille Cave, and also to understand some questions relative to the perception of the pathological conditions among the people who inhabited the site during Prehistoric times, about some ideas relative to first aids or health care.

In every case, also a comparative analysis with other sites inside the Southeast Asia-Pacific region will be committed, in order to offer the reader a basic idea about the current status of the investigations and the knowledge we have about each group of pathologies in the area, what also would help us to understand different dynamics related to the paleopathologies and the indicators of health care through all these extended area, in which different social models and ambiental responses will be noticed.

Finally, after all this perspectival approaches to the pathologies registered, the work will be closed with a final discussion about the health care perspective and the social and environmental implications about it in Ille Cave, crossing the osteological data collected

with other aspects already studied in the site, such as the ambience (flora and fauna), landscape or some dietary ideas (section 5.4). A critical approach to the present work will be also provided, in the shape of a final section (section 5.5) which will offer some tasks which were not developed and which could be included as future perspectives or ideas for future studies.

5.2. DENTAL PATHOLOGY.

- **5.2.1. Dental calculus and signs of buccal infection.**

As may be observed in Chapter 4.3.1, the presence of calculus in the teeth of Ille Cave individuals is present in all the studied cases, what is really normal in other prehistoric places of Southeast Asia for similar chronologies. A good example is the case of Non Nok Tha, a good representative of the Neolithic and the Metal Ages (till the preangkorian Iron Age) of Thailand. This site, which we can recognize as an important cemetery area (just a few industrial and occupational episodes in all the stratigraphy, which offers a complete sequence from around 5000/4500 years BP to around 1800 BP), is a good example of the high rates of frequency of registered calculus in adults (TOOMAY DOUGLAS, 2006, pp.203-204). This possibly would be related to some kind of factors which would create an alkaline ambience in the mouth which would make the dental plaque to appear easily or maybe to a poorer oral hygiene. In any Non Nok Tha seems an interesting case, since the masculine individuals present calculus much more frequently than the females, although the explanation to this phenomenon is not conclusive (in the case of Ille, the distribution doesn´t seem to response to gender reasons, affecting to all the cases without any distinction).

If the advanced calculus is present in more than half part of the individuals of Non Nok Tha, the alveolar resorption is present in almost the third part of the population (TOOMAY, DOUGLAS, 2006, pp.214), while in Ille Cave appears in almost every case. This doesn´t mean in any case that Ille Cave shows a higher rate of frequency in periodontal disease that the ones from the series of Non Not Tha: we need to insist again in the fact that our skeletal remains are quite worst preserved, and also in the fact that our statistical analysis can´t be achieved, since we made it just over 20 individuals (not enough for this kind of studies), so the representativeness of the individuals analyzed inside of the collection is still a big question to be solved with the study of

other chronologies inside of the site and the recovery of other prehistoric human remains still buried.

Some factors, that we will analyze latter for the case of the caries (*vid infra*: 4.2.2), can be great enhancers for the presence of calculus in the dental pieces. The chewing of betel nut and some dietary components (such as the water hardness or the presence of silicon contents, present in rice or beer, for example) could explain the high profusion of the condition in Ille populations (TOOMAY DOUGLAS, 2006, pp.214). As we will see in the next section of this chapter, the rice agriculture can´t explain the particular case of Ille Cave (hasn´t been documented), but for example the betel nut has been registered in several ways (MEDRANA, 2002, pp.44; CARLOS, 2010, pp.19).

- **5.2.2. Dental caries.**

Is interesting to notice that several studies (ORTNER, 2003, pp.591; TOOMAY DOUGLAS, 2006, pp.191) have concluded that carious process are more typically associated to agriculturalist societies, in which their frequency of appearing is much higher than in the case of hunters-gatherers, as the result of the presence of more fermentable carbohydrates associated to the consumption of different species of plants.

Although, is important to introduce here an interesting idea that affects to Southeast Asia populations: the fact that the grasses and grains of rice, typically consumed by these populations, are not as cariogenic as other plants consumed by other agriculturalist societies around the world (TOOMAY, DOUGLAS, 2006, pp.192). As a result of this fact, is true that normally the presence of caries manifest in a smaller amount in the osteological register from archaeological sites in this areas: proportionally, less individuals present this condition in Southeast Asia sites. Some good examples in this sense are the few cases registered in the permanent dentition of Neolithic-Iron Age sites as Non Nok Tak in Thailand (TOOMAY, DOUGLAS, 2006, pp.203), which offers a long chronology between 5000/4500 and 1800 BP, and where we can also observe the fact than the carious process are more frequent in the mandibular molars that in other parts of the mouth (actually in Ille Cave both the cases documented also appear in mandibular molars) and in the occlusal or interproximal surfaces of the teeth, as we referred before. In Ille Cave, as introduced in Chapter 4.3.2, we have one case of each of these situations (occlusal and interproximal), so the pattern seems comparable. Also in the Bronze Age site of Ban Lum Khao or the pre-angkorian Iron Age site of Noen U-

Loke (DOMETT, TAYLES, 2006a, pp.230; TAYLES, DOMETT, NELSEN, 2000, pp.71-72), both in the Thai valley of the Nun River, we can observe again that the total proportion of carious lesions was really similar between samples, always in this low ranges exposed for other sites: 4.5% of the osteological assemblage from Ban Lum Khao and 4.8% for the case of Noen U-Loke.

Even if these three cases serve as a good example, the low rates for carious lesions are generalized for all Southeast Asia, as the extended bibliography written about these explanations states. For example, multi-regional studies such as the ones carried out by Mark Oxenham, who can give a good perspective about the very low frequencies of carious lesions in the pre-agricultural (c.5000 BP) and rice-based agricultural (c.2500-1700 BP) period of Northern Vietnam, with ratios of frequency for carious lesions between 1.5% and 10.9% in all the collections of these area, insisting again in the rice-based diet explanation, and in which enumerates a long list of up to 12 sites which also show a bigger frequency of carious lesions in the posterior mandibular teeth (OXENHAM, LAN CIJONG, KIM THUY, 2006, pp.274).

The problem that we have with the previous interpretation is the fact that rice agriculture has not yet been identified in the archaeological record of Ille Cave. Therefore, this generalized model for other regions can´t be applied to the particular case of Ille. Maybe the low rate of carious lesions in Ille (present just in two of the eight cases of individuals which conserved dental pieces) could be explained as a result of the small sample size of human remains or the preservation status. Maybe trough other factors which speak about dental care and hygiene, such as the consumption of betel nut (*areca catechu*), which has been documented in the paleobotanical record (CARLOS, 2010, pp.19), but could also be indirectly inferred from the unusual teeth wear pattern of one of the individuals in our study (section 4.2.5) and other previous studies of the dentition in Ille (MEDRANA, 2002, pp.44). The consumption of betel nut is quite frequent in ancient Asian populations and especially documented in the case of the Philippine archipelago, both through the archaeology (OXENHAM, LAN CIJONG, KIM THUY, 2006, pp.264) and the ethnographical records of the precolonial era (HENRY SCOTT, 1994, pp.49). The chewing of betel nut has been associated in the literature with cariostatic properties (TOOMAY, DOUGLAS, 2006, pp.216), as the addition of lime to the chew results in an alkaline environment in the mouth which

difficult the presence of carious bacteria (but contributes to the appearance of calculus, for example).

Would be necessary to introduce here also the case of the early metallurgic site of Man Bac, in Vietnam North-East coast (OXENHAM, MATSUMURA, KIM DUNG, 2010, pp.87-88), the site in all Southeast Asia with a higher rate of representation of carious lesions between the populations: 11%, lightly superior than the 10.9% of the close site of Khok Phanom Di. While in Khok Phanom Di the high rate has been explained through the consumption of some cariogenic foods, such as the taro, the banana or the yam; the case of Man Bac remains a mystery. The introduction of rice in the diet of Man Bac has been long documented, and their diet included more than 50% of seafood and fish, but no cariogenic food has been registered in their diet furthermore. Is important to introduce here this case as an example of how much variables out of the topics exposed here can be present in this kind of studies.

Is also interesting to mention here an study (OXENHAM, LAN CIJONG, KIM THUY, 2006, pp.273) which have allowed to determine that the presence of carious lesions is more frequent between female individuals than in males for the case of Southeast Asian populations, possibly not because of biological reasons (for example, the different rhythm in teeth exposure), but in relation to different cultural behaviors within the population: diversifications of activities by gender (women would be more linked to agricultural labors, while the males would maintain the hunter activities), or the differences of diet as a result of these labor links, since they would eat more carbohydrates (they are more close to the products proceeding from the agriculture) and the males more proteins (TOOMAY, DOUGLAS, 2006, pp.192). In this sense, the Vietnamese sites of Man Bac and Da But are again a good example, since gender-related studies where committed (OXENHAM, MATSUMURA, KIM DUNG, 2010, pp.87). Unfortunately in the case of Ille Cave, as stated (section 4.1.2), we can´t stablish any gender-related analysis as the assemblage doesn't present enough cases for a statistical analysis, but we can state that both the caries samples that where noticed belong to a clear male and a probable male individual.

- **5.2.3. Dental enamel hypoplasia (DEH/LEH).**

As could be appreciated in the previous chapter (Chapter 3.3.4), all the cases of DEH detected in Ille Cave appeared in the frontal teeth (incisives and canines, a case of first premolars) of both mandible and maxilla. This prevalence in the frontal teeth is logical according to the teeth formation patterns during childhood (giving us information about the period between 7-12 years, when this teeth erupt, according to Ubelaker 1989: WHITE, BLACK, FOLKENS, 2012, pp.386), and actually is present in the rest of Southeast Asia sites which will afford us a comparative study (*vide infra*), sites which also focused their diagnosis process in the frontal dentition.

As we said, the presence of DEH in our studied assemblage is of 50% of the individuals in which we documented pathological conditions, or 62.5% if we attend to the individuals in which dental pieces where still present (just 8 cases). This would position Ille Cave as a case study of high presence of DEH within its population, comparing to other Southeast Asia sites. Definitely not in the line of sites as Man Bac in Vietnam, with a 100% of frequency ratio, or the neighbor Da But, with a 72% (OXENHAM, MATSUMURA, KIM DUNG, 2010, pp.90), both cases which we could consider as exceptional cases with too high rates. The case of Ille, instead, presents a percentage more in the line of the general patterns: 37.1% in Shi San Hang (Taiwan), the Thai sites of Ban Chiang (20.8%) or Khok Phanom Di (43.8%), or even the percentage of 32.5% registered in the Marianas Islands (PIETRUSEWSKY, TSANG, 2003, pp.212).

These cases point always to a high presence of infant stress, but which we always have to understand inside of the parameters of the normality for this ancient societies, even when we find other specific cases in the region which point to societies with lower infantile stress (Ban Lum Khao, with 12.1%, and Noen U-Loke, with 10.7%, are interesting examples in Thailand preangkorian Bronze and Iron ages, especially in cases of big demographic index which will sustain the development of the Khmer empire; or the prehistoric Hawaii, with just a 7.7% of cases of DEH: PIETRUSEWSKY, TSANG, 2003, pp.212).

Is necessary to remember again that the assemblage studied for the case of Ille was quite reduced for a representative statistical study, so we have to be cautious with this kind of comparisons, which possibly will suffer modifications when more prehistoric sites are studied in the Philippines.

All the cited places, in fact, also offered interesting information about the differential presence of DEH between both sexes: in all the cases, female individuals presented DEH in quite bigger percentages that the ones for male individuals. In every case this was explained from a plausible difference in the diet of the female children in comparison with their male partners (PIETRUSEWSKY, TSANG, 2003, pp.210; OXENHAM, MATSUMURA, KIM DUNG, 2010, pp.90). Again, Ille can´t be introduced in this kind of studies, since just a few individuals sustain the analysis and the sexual diagnosis was not confident in many cases.

- **5.2.4. Non-masticatory tooth wear patterns and their possible cultural-functional implications.**

As was already introduced in Chapter 4.3.5, several unusual tooth wear patterns where noticed in Ille Cave assemblage. The first of it, the one affecting the frontal mandibular teeth of the individuals recovered from context 755 and 2247, possibly would response to a practice of the use of the mouth as third hand in any kind of activity.

Several paramasticatory activities have been documented for contemporaneous aboriginal human groups, especially in the case of the Eskimos/Inuit and the Australian aborigines. The same marks that the ones observed in our two individuals are related in these groups to activities which imply the use of the mouth as third hand, and the action of pulling outward and downward with both hands over the object which they hold with the frontal teeth (normally related to the treatment of animal skins for the manufacture of leathers, as can be observed in Plate 5.1). This non-masticatory pulling and stripping activities produce a “relative severe and often rounded wear” on incisors and canines” (HINTON, 1981, pp.556) of both Eskimos and Australian tribal groups, following exactly the same pattern that the one documented for the individuals from the contexts 755 and 2247 of Ille Cave (Chapter 4.3.5). The Inuit case is quite evident, since women still play the practice of softening the skin thought this pulling process, as we can see in Plate 5.1, while men perform different labors inside the community, more oriented to get the food by hunting (RAYE WOOD, 1992, pp.30). So furthermore we can recognize the documentation of the use of the mouth as third hand in pulling and stripping activities (possibly leather softening) in our site of study.

PLATE 5.1. Pictures showing two Inuit women performing an activity which implies the use of the frontal teeth as third hand: the chewing of animal skins. Below, dentition recovered from a prehistoric Eskimo site, in which we can observe the wear pattern left by this kind of activities (From: HINTON, 1981).

Is interesting the fact that has been proved (TOOMAY, DOUGLAS, 2006, pp.191) that the human groups which follow subsistence regimes typical in hunter-gatherer societies (like the ones referred, for example) tend to exhibit this relatively heavy wear in the frontal dental pieces of adult individuals as a result of the use of the mouth as third hand, especially in the case of the mandibular teeth, with also this tendency to the rounded wear pattern (HINTON, 1981, pp.562-563). Meanwhile, groups which somehow depend to varied degrees in food production present the molars quite more weared that in the hunter-gatherer societies, and the pattern in frontal dentition uses to give the pieces a cupper wear appearance, linked to the grinding functions developed in the frontal mouth area. This, together with the light presence of the caries and an only case of AMTL would point, *a* priori and always according to this studies, to a hunter-gatherer economic model for Ille Cave, although the intrinsecal limitations of our study (small sample analyzed, not representative enough) and the particularities of the

prehistoric societies of the Philippines have to make us feel cautious about this kind of definition (actually is really possible that we can be facing a mix economic model, as we will observe in section 5.4).

The other unusual wear pattern registered in Ille Cave, as displayed before (Chapter 4.3.5), affected the mandibular molars of the individual retrieved in the context 727. Normally, this wear patterns which affect so much the molar area but don´t affect the frontal teeth are associated with several activities which involve the deeper dentition (MICKLEBURGH, 2007, pp.50-52), such as the following ones:

- Crashing bones with the molars.
- Killing fishes with a bite during fishing labors, or cracking crabs or shells.
- Chewing hard rubbery aliments (for example, seal dry skin in Inuit populations, as we can see in the image below).
- Consumption of hard nuts.
- Some activities which pretend the creation of industries which require the chewing of lianas.

Among these options, the case of the chew of hard aliments was discarded immediately: the diet in Ille Cave didn´t include any rubbery aliment, plus the bibliographical research allowed us to confirm that the wear pattern in this cases, although similar to the one present in our individual, used to had more repercussion over the mesial and distal surfaces of the teeth (in our case the disposition is lingual-buccal), as we can observe in Plate 5.2, from the Inuit site of Sadlermiut (RAYE WOOD, 1992, pp.136-138).

PLATE 5.2. Image of the wear pattern shown in the mandibular molars of the individual 61 of the archaeological Inuit site of Sadlermiut: similar to the case from context 727 of Ille, but in this case explained because the chew of hard-rubbery aliments (From: RAYE WOOD, 1992).

The most probable option for the case of Ille Cave was the chew of nuts, since, as was discussed for the case of the carious formations of our assemblage (4.2.2), the chew of betel nut (*areca catechu*) has been documented in Southeast Asian skeletal collections in similar patterns than the one been studied here (PIETRUSEWSKY, TOOMAY, DOUGLAS, 2011, pp.74), or in other close regions (FITZPATRICK, NELSON, REEVES, 2003). But has also been documented in Ille Cave in other previous dental analysis (MEDRANA, 2002 pp.44), and also in the paleobotanical studies (CARLOS, 2010, pp.19), as well as in the ethnographical register of prehispanic Philippines (HENRY SCOTT, 1994, pp.49) and other several cases of the region. In fact, some authors have even documented the origins on the use of betel nut in the southern Philippines (Visayas-Mindanao) and Borneo, with a posterior expansion to the rest of Island Southeast Asia and the continental lands (FULLER *et al.*, 2011).

This practice, quite common not also in prehistoric Asian populations, but even between the contemporaneous indigenous people (in almost all the territory: Northern Palawan, Visayas, diverse regions of Mindanao and in the Cordillera region of central Luzon) uses to follow the same ritual: the preparation before the chewing process would start with the cut of the areca palm nut into segments, which was wrapped in a leaf of betel piper vine, together with lime made of shells and other possible aromatic or flavoring elements (we ourselves could observe the use of tobacco leaves in this sense during our stance in the Cordillera region, but the ancient registers speak us also about the use of cinnamon sticks in the Visayas, just for give an example: HENRY SCOTT, 1994, pp.49), giving as a result of the process the quid which would be chewed. This sequence of preparation and the materials used can be observed in Plate 5.3.

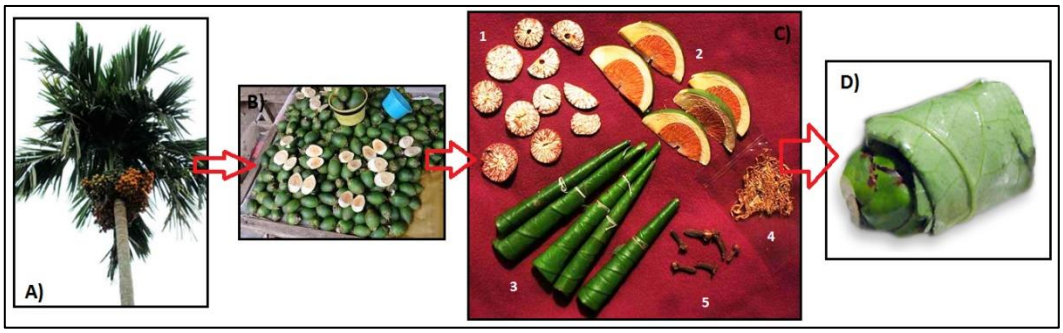


PLATE 5.3. Process of the preparation of betel nut (*nga-nga*) in Philippines: A,B) recovery of the *areca catechu*, C) preparation of raw materials (1: sliced nut without the pulp of the fruit, 2: including the pulp, 3: betel leaves or *ikmo*; 4: *mascada* or dry chewing tobacco leaves, 5: some lime or *apog*), D) chewing quid (From: author, over HENRY SCOTT, 1994).

The chew of betel nut has several properties which would explain why the Asian populations would have introduced it as a habit. The main one is its cariostatic effect (TOOMAY, DOUGLAS, 2006, pp.216): the lime helps to develop an alkaline environment which prevents the appearance of carious lesions, as we saw before (*vid supra*: 4.2.2). Unfortunately, this alkaline ambience makes easier the appearance of calculus deposits over the teeth, dental infections process, etc (*vid supra*: 4.2.1).

Apart of the different pathologies which the consumption of betel nut would leave in the soft tissues of the mouth and its mucosa (TRIVEDY, CRAIG, WARNAKULASURIYA, 2002), also different markers have been observed in the dental pieces of archaeological populations thought Asia: the wear pattern of our individual would fix quite well inside this patterns, which are always present in the molar area (being specially abrasive in the case of the last molar pieces, since the quid is chewed in the deeper part of the mouth) and over the buccal-labial surfaces (is chewed between the dentition and the cheeks, for avoiding choking, since after the process all the remains of the chewed quid are spited out). The only problem we have in our case of study is that the remain enamel is not tinted in the typical reddish coloration (Plate 5.4), as in other cases of Ille Cave (MEDRANA, 2002 pp.44) or other archaeological registers, but could be the result of a strong chemical attrition or postdepositional process (actually the exposed pulps are quite orange-colored, but not much enamel is present, so we can´t determine clearly the coloration of it). So, furthermore, we can conclude a possible, but not definitive, case of non-dietary chewing of betel nut for the individual from the context 727.

Although is true that this betel nut consumption case was registered in a probable female individual, and the frontal teeth wear pattern appeared in two males (a definite male and a probable one: *vid supra*), we can´t speak about the division of these labors or practices between genders in Ille, since the activity patterns are not representative enough (just three cases in a small group of 20 individuals studied). Maybe deeper studies in the future could allow us to commit this kind of studies in the prehistoric Philippines archipelago.

PLATE 5.4. Archaeological-ethnographical comparison: top, reddish dentition of betel nut chewers from the Ifugao people (Banaue, Philippine Cordillera); down, and a sample case of a mandible proceeding from a prehistoric site in Palau, Micronesia (From: FITZPATRICK, NELSON, REEVES, 2003).

5.3. NON-DENTAL PATHOLOGY.

- **5.3.1. Cribra orbitalia.**

This manifestation has been traditionally associated with hematological imbalances in the diet of ancient populations (NAVEED *et al.*, 2012, pp.394): anemias, bone marrow malignances, metabolic disturbances). But currently the debate about this question is still going: new medical studies suggest that, more than iron-deficiency anemia, the probable reason for the presence of this pathological condition would be a lack of vitamin B-12 in these populations (WALKER *et al.*, 2009, pp.119). In any case, this lack of nutrients can be explained trough different perspectives: a lack of nutrients during the pregnancy which would affect the neonatal or cases of malnutrition (especially in subadults individuals, since the pathology is specially prominent beneath

the younger age rates) seem reasonable factors to take into account, but also infectious diseases (for example diarrheal diseases, normally present in this kind of populations because of the unsanitary living conditions and the profusion of parasite loads, and which cause significant nutrient loss) or a lack of animal products in the diet (especially meaningful in agriculturalist societies in which the ambience doesn´t offer enough faunal-origin supplies -for example, cases of overexploitation of animal resources-, or in the case of the people with lower social ranks, which can be linked to a worst access to this resources in diet) are other possible explanations to the presence of this pathology (WALKER *et al.*, 2009, pp.119-120).

Other studies which have been committed in Southeast Asia (a good example are the Vietnamese sites of Man Bac and Da But, previously cited: OXENHAM, MATSUMURA, KIM DUNG, 2010, pp.90) also seem to suggest a bigger presence of the pathology in feminine individuals, what could be related to a dietary differences, possibly as a response of a lack of the described nutrients in the women diet, which would be closer to agricultural products, while the men would consume more animal products as a consequence of their direct relation with hunting activities. Unfortunately, in the case of Ille Cave we just could register a case, so we can commit this kind of studies (although is interesting to notice that, in our case, we were facing a probably female individual).

- **5.3.2. Degenerative joint disease.**

In Chapter 4.2.2 the results for the determination of degenerative joint disease where already presented: 5 of the 20 individuals (25%) studied presented any variety of this condition, distinguishing between: osteoarthritis (individuals 727 and 2247: 2/20), Schmorl´s nodules (individuals 484 and 2247: 2/20), minor markers of degeneration in the column (individual 755: 1/20) and signs which appeared in other articulations outside of the column (the elbow of 2240 and the shoulder of 2247: 2/20). These varieties accumulated in the same individual for the cases from context 2240 (with minor lipping both in the column and in the elbow) and 2247 (which offered positive results for vertebral osteoarthritis and Schmorl´s nodes, plus some minor signs of degeneration in the shoulder joint).

In a general perspective, the presence of degenerative joint disease is almost absolute in Southeast Asian skeletal assemblages (DOMETT, O´REILLY, 2009, pp.72), although

not so many studies focused their attention in these pathological variety (the literature seems to be much more prolific in dental health and skeletal trauma). Study cases as the ones committed over several central Thailand sites of the Metal Period (LIU, 2012, pp.374-375 - Several sites; DOMETT, O´REILLY, 2009, pp.72 - Phum Snay) shown that, between other several factors (age, genetics, physical condition), the degeneration process in the column and, more specifically, the vertebral osteoarthritis, can be also a response to activities which induct stress over the anatomical region: a good example is the site of Non Mak La, in which 19 individuals reported degenerative joint diseases, and in which the agriculture labors and the transport of weight can explain perfectly the presence of this pathological conditions in the column of the skeletons. Even if this presence of the columnar affections is, as said before, recurrent, sites as Ban Mai Chaimongkol or Ban Pong Manao (LIU, 2012, pp.241) shown that other areas can be affected (in the case of Ban Mai Chaimongkol, 4 individuals present degenerative joint disease in the column, but also a case in the shoulder and another one in the knee where documented; in Ban Pong Manao, aside of the 5 columnar cases, one in a hip and three in the feet). In this sense, the most typical areas affected are wrist/hands, as a consequence of the ceramic manufacture labors (LIU, 2012, pp.375; DOMETT, 2001, Chapter 5); the feet, as the result of intense locomotion (as in Bun Lum Kao: DOMETT, 2001); or the shoulders, possibly because of paddling activities (DOMETT, 2001, Chapter 5).

Again, the case of Ille Cave presented here doesn´t allow a comparative study, nor the relation of the conditions to any specific practice.

- **5.3.3. Infectious diseases.**

As presented in Chapter 4.4.3, two of the 20 individuals analyzed also presented cases of infectious diseases: a case of osteomyelitis in the individual from context 703, and signs of periostitis and pubic osteitis (together with other smaller markers of non-specific infectious process) in the individual from context 2247.

The literature about infectious diseases in Southeast Asia is still quite brief for allow a comparative study, although the team of Marc Oxenham, which worked in several sites in Northern Vietnam, has already noticed some interesting facts in the area. According to his study, carried on over 96 individuals of the Da But period (Neolithic) and other 96 individuals from the Metal Age phases of several close sites in the same region

(OXENHAM, KIM THUY, LAN CUONG, 2005, pp.372-373), the infectious diseases are present in a small proportion in the Neolithic times (just 1/96 cases of the studied assemblage), while in the Metal Period their presence increases considerably (10/96 cases). He explains this increase because of the presence of new pathogen agents, which appeared with the sedentary way of life and the domestication of some animal species, and which become more virulent trough time, being especially strong during the Metal Period because of the demographical growth. Other recent studies of the same author, for sites such as Ban Chiang, continue pointing in the same direction (PIETRUSEWSKY, TOOMAY DOUGLAS, 2011, pp.169-171).

Unfortunately, not much more studies have been done about infectious diseases in other areas of Southeast Asia yet, although the incoming publications of other Vietnamese sites (soon the well-studied Man Bac, for example) hopefully would ease the development of the bibliography by other teams working in other regions.

In the case of Ille Cave, with a presence of infectious diseases of 10%, can´t be concluded yet how representative this proportion is of the real situation (note: two cases over a sample of 20 individuals). Is necessary, in this sense, to continue studying other individuals recovered on the site for a better statistic, plus compare it with other Philippine sites which could contribute to this point of view about the infections in the Prehistoric Southeast Asia which is still under construction.

For conclude, can be noticed that the diseases present in the studied assemblage are quite normal and well known in the archaeological register for other areas (in fact, the periostitis is the most typically registered between the infectious diseases: ROBERTS, MANCHESTER, 2010, pp.417), so the results shouldn’t surprise the reader in this sense, since are within the parameters of normality.

- **5.3.4. Healed fractures (trauma).**

Three cases of healed fractures were also presented in Chapter 4.4.4. The first of these cases was the healed nasal fracture in the individual from context 2247. Normally this kind of contusions are quite representative in cases of interpersonal violence or as a result of accidents from everyday activities which are conducted in an inhospitable environment (as in Plate 5.5; TORRES-ROUFF, COSTA-JUNQUEIRA, LLAGOSTERA, 2005, pp.78), but in any case couldn´t be determined exactly what caused this injury, although it seems the consequence of a lateral impact. Anyway, as

we will observe in the other healed fractures, seems logical to understand that in Ille Cave couldn´t be registered any phase of strong social violence, since just a few cases where documented and in all of them the fact than the fractures where healed pointed to situations of social care.

PLATE 5.5. Some examples of nasal fractures from the archaeological site of Coyo Oriente, Atacama Desert, Chile (pre-Tiwanaku). Notice the misaligned overlapping bonny fragments in the upper image, and the horizontal fracture in the inferior one, similar to our case of study (From: LESSA, MENDOÇA DE SOUZA, 2006, pp.135; TORRES-ROUFF, COSTA-JUNQUEIRA, LLAGOSTERA, 2005, pp.78).

The second healed trauma documented is a healed oblique fracture in the left femur of the individual recovered in context 1825. This kind of trauma would have clearly affected to the mobility of the individual for the rest of his life time (WEBB, 1995, pp.198), so we could infer here questions related to his care from the rest of the community. Obviously this kind of fracture would have resulted in the fact than this leg was shorter than the opposite limb, producing locomotional disturbances, or even making impossible the movement of the individual. Although we can notice little attempt or lack of success in reducing this fracture, given the overlapping heal process (presumable lack of first aids: WEBB, 1995, pp.196), is true that this individual survived at least till the fracture was completely healed (process which takes at least 10 months), so some help from his partners would have been required for his subsistence (maybe he was not able to provide food anymore cause of this condition, but was able to contribute to the community life otherwise).

In the same sense would point the third case of trauma registered in the assemblage: the costovertebral trauma of the individual from context 484. If the healed femoral fracture would have, somehow, made more difficult the locomotion of the individual who suffered it, this case seems even worst: the dislocated superior ribs of the right side of the thorax, accumulated over the 8^{th} rib after the trauma, would have been a clearly focus of strong pain and infections (as show the different signs of the process registered in the column). The thoracic cage would have partially lost his shape, making the movement really painful, if not impossible, for an individual which surely survived enough time for allow the ribs to react trough the growth of new bone tissue, around their extremity of insertion with the column, creating the several flat surfaces which can be observed now in the bones and which showed the overlapping between bones which allowed the reassemblage of the thoracic cage.

Unfortunately not much more bones of this individual where present, so that was not possible to infer potential consequences of this strong trauma in other parts of the organism couldn´t be noticed (the few bones present didn´t show any kind of pathological marker). Although, if the case of the healed femoral fracture already offered some ideas about the lack of knowledge of first aids in Ille Cave communities, in this case the idea becomes stronger: logical, since the reduction of a femoral fracture seems a much more simple proceeding that the stabilization of several dislocated ribs. In a more positive sense, as in the femoral case, this strong thoracic trauma is again a

prove than the community had a perception of the health care which worked much better in long terms: the individual survived, at least for some time, and of course this would have been impossible without the support of a community which took care of him, and was able to understand his importance furthermore the fact that maybe was not so "useful" for the daily activities anymore.

In a more general sense, the bibliographical references we have about traumatic lesions in Southeast Asia are quite brief, and normally referring to archaeological sites in which the presence of this kind of pathologies is more representative because of specific social dynamics. A good example in this sense are sites as Phum Snay, in Cambodia, where the high rates of traumatic lessons in the skull and facial area have been interpreted as the results of convulse times which would lead to the establishment of the Angkorian reign, times in which the interpersonal violence markers and the frequent appearance of weaponry in archaeological contexts (DOMETT, O´REILLY, BUCKLEY, 2011). Also the Indus Valley civilizations (Harappa, Mohenjo-Daro: 2600-1900 BP) are a great example of high rates of traumatic lesions (especially nasal fractures, as the one we registered in Ille Cave, and which together with the injuries of the cranial vault appear in up to 15,5% of Harappa necropolis) linked to violent periods associated with the formation of big states (ROBBINS SCHUG, GRAY, MUSHRIF-TRIPATHY, SANKHYAN, 2012, pp.9).

If we leave apart these specific cases of convulsions over big demographically developed societies, the general pattern for the prehistoric incidence of traumatic lesions is Southeast Asia gets significantly reduced. During the Neolithic of sites as Ban Chiang in Thailand (PIETRUSEWSKY, TOOMAY DOUGLAS, 2002, pp-170-171), the presence of trauma is explained as the result of ambience and accidental origins, given the much more random distribution in the sequence for this period. In the posterior phases of the same site, we can observe that actually the presence of traumatisms increases significantly during the Bronze Age, possibly as consequence of the intensification of the agriculture, the sedentary lifestyle and the bigger population density, but in any case never with such a presence as the one documented from the preangkorian Iron or the Indus Valley. In the same sense, we have several sites in Vietnam (OXENHAM, 2006, pp.227), as the case of Da But, in which the presence of transverse fractures of the midshaft femur with diaphyseal overlapping (like the one we registered in Ille context 1825) just arrives to a 6,5% (being one of the biggest rates in

the region of study), a percentage than together with the low presence of weaponry in the site allowed the scientist to infer that the traumatism in this sites proceeded from accidental falls or even animal attacks (OXENHAM, 2006, pp.232). Island sites, as the ones previously treated for Taiwan (PIETRUSEWSKY, TSANG, 2003) continue pointing to these lower rates.

Also, comparative studies such as the ones accomplished in Thailand sites for the transition from Neolithic to Bronze Age (Khok Phanom Di, Nong Nor, Ban Lum Khao, Ban Na Di: DOMETT, TAYLES, 2006b, pp.190) show again this idea that the fractures in the bones are more frequent with the intensification of the agriculture, possibly as a result of the presence of activities directed to create new spaces for developing this activities (DOMETT, TAYLES, 2006b, pp.198-199), while the few cases of facial fractures start to be significant in the later phases, as a result of possible cases of interpersonal violence (DOMETT, TAYLES, 2006b, pp.203-204).

The case of Ille Cave possibly would point to accidental-origin traumas: the costovertebral and femoral fractures registered are cases which point in this sense, since we have no evidence of particular moments of social convulsions. The hunting practice and its locomotional implications, as well as the landscape (geological relief), are two factors to take in account for trying to explain the small presence of bone trauma in the assemblage, which furthermore was healed in every case (the misaligned healed fractures would point to a lack of knowledge about first aids, but at the same time to the preoccupation by the rest of the community). We can´t determine if the case of nasal fracture has its origin in an accident or in interpersonal violence, since is just one case over 20 individuals analyzed, but again we insist that the presence of trauma (3/20 individuals) points to an accidental origin more than to internal social fights. Again, the fact that the stratigraphic sequence is so difficult to interpret, and that our study just focus on a small part of the osteological assemblage in the site, together with the fact that we had no signs of rice agriculture practice in the site, made impossible evolutionary analysis as the ones explained for mainland Southeast Asia.

5.4. CONCLUSION: SOME IDEAS ABOUT THE HEALTH AND THE LIFESTYLE OF ILLE CAVE PREHISTORIC POPULATIONS.

From the present work, some basic conclusions can be extracted here relative to the lifestyle and the health care in the prehistoric populations from Ille Cave:

- The main objective of our study, the assessment of the evidence of pathological lesions in the prehistoric populations of Ille Cave, clearly succeeded, as the results exposed in Chapter 4 and Annex III can prove.
- In relation to the dental pathologies registered in Ille assemblage, is interesting to notice the frequent presence of periodontal disease and calculus, which appear in almost all the individuals, as explained in section 5.2.1. This could be a consequence of the frequent use of elements such as the lime from the betel nut, which creates an alkaline environment in the mouth which facilitates the presence of these conditions. Although, is important to say here that in other similar sites from Southeast Asia, as the ones used in the present study for the comparative, the presence of both this conditions is also a constant, which could also be interpreted from the absence of dental hygiene. In this sense, Ille Cave is inside the parameters of what can be considered a normal pattern.
- The chew of betel nut (section 5.2.4), which was already proved for Ille Cave before the development of the present work (MEDRANA, 2002), has also benefits for the dental health, such as the cariogenic properties: in this sense, maybe some ideas about dental care could be inferred for this population, although is true that its consumption could be the result of other factors (cultural reasons, avoid the altitude sickness, vice). This could explain the low rates of carious lesions in the assemblage studied (5.2.2), which furthermore is comparable to other sites of Southeast Asia in which the low rates can be explained by the introduction of rice as dietary base (in Ille there are no signs of rice agriculture).
- The fact that the people of Ille used their teeth as third hand in the development of some kind of cultural-economical activities has been proved trough the analysis of the non-masticatory wear patterns of the frontal teeth in two of the individuals studied, as displayed also in section 5.2.4. This pattern is normally associated with activities which are normally developed by hunter-gatherers societies.

- Some metabolic disturbances can be observed also in the adult individuals which origins we have to search in the childhood. The DEH (see section 5.2.3) points to this kind of disturbances, normally related to diet, in an interval between 7 and 12 years old (the time in which the frontal definitive teeth erupt). Meanwhile, the case of cribra orbitalia points to a particular case of anemia or lack of vitamin B-12 (still in debate) during the sub-adult times, as discuses in section 5.3.1. Both this cases can point to dietary disturbances associated to the younger periods of the life of Ille people.
- Some other pathologies, such as the trauma (5.3.4), can be understood also inside the normal patterns for this kind of societies, as shows the comparison of Ille Cave ratios of presence with the ones from the other Southeast Asian sites described. Their reduced presence can be a sign of the accidental origin of the conditions, together with the fact that no determinative signs of interpersonal violence or conflicts have been noticed in Ille Cave, as discussed in section 5.3.4.
- The environment around Ille Cave is also an important factor to take into account: the geological relief (for example in the karst itself), the profuse forest which covers the territory (CARLOS, 2010, pp.90-91) or the presence of savage animals which could actually wound the inhabitants during their quotidian labors of hunting, such as big mammals and possibly felines (OCHOA, 2009, pp.111-112), are just some examples of a risky ambience which could become hostile enough for causing the pathologies present in the assemblage.
- In this sense, the present work proves that, nowadays, we have no signs of the practice of first aids over this presumably accidental injuries (actually no one of the registered traumas was reduced, as explained in section 5.3.4); although the consumption of medicinal plants and the possibility of palliative cares could be a reality. Actually, several plants have been documented in Ille Cave which have medical properties (CARLOS, 2010, pp.55): *buchanania arborescens*, traditionally used for healing wounds and cuts; *eupatorium odoratum*, for skin wounds and reducing the fever; or *eleusine indica*, another febrifuge.
- What seems clear is that, in cases such as the femoral fracture or the hard costovertebral trauma (5.3.4), the growth of the bone (which completely healed, although misaligned, the femoral fracture, and which was also present in the

costovertebral case) demonstrates that the individuals survived to this injuries, which would have made them incapable at least for some time. The long term care of these individuals by the community seems logical and proves that, at some point, there was some concern about the pain of the others and the presence of these unfortunate conditions as part of their daily lives.

- All this notes could be understood from the perspective of a mix economic model: hunter-gatherers which had some punctual domesticated plants and animals, but which still have the forest resources as first focus of their activities and main source of their food and raw materials, what would imply the necessity of movement around the territory, and so the exposure to possible risks which could cause the injuries.
- This idea of an economical model based in the forest resources was already noticed in previous works on Ille Cave, such as the study of the macrobotanical remains (CARLOS, 2010, pp.90). Actually, the current tribal populations of Northern Palawan, the Tagbanwa and Batak peoples (DRESSLER, 2005; BOISSIÈRE, LISWANTI, 2006), still maintain this model which combines the hunting/fishing and gathering of natural resources in the inland forest with punctual domestication of animals and a little non-monocrop horticulture (swidden farming: small surfaces in the forest which they burnt, plant and abandon after the land loses fertility). In Plate 5.6 we can see some sample images of the Batak people performing these subsistence activities.
- Furthermore, no signs of sexual diversification where registered in Ille, neither for the pathological conditions, nor for the possible activities registered, as displayed in Chapter 4. This could represent the reality or be just a consequence of the reduced assemblage selected as sample for this work.
- In the same sense, the lack of absolute data in Ille Cave site for the layers studied makes impossible any case of evolutionary study about the health perceptions, as was also discussed in Chapter 4.

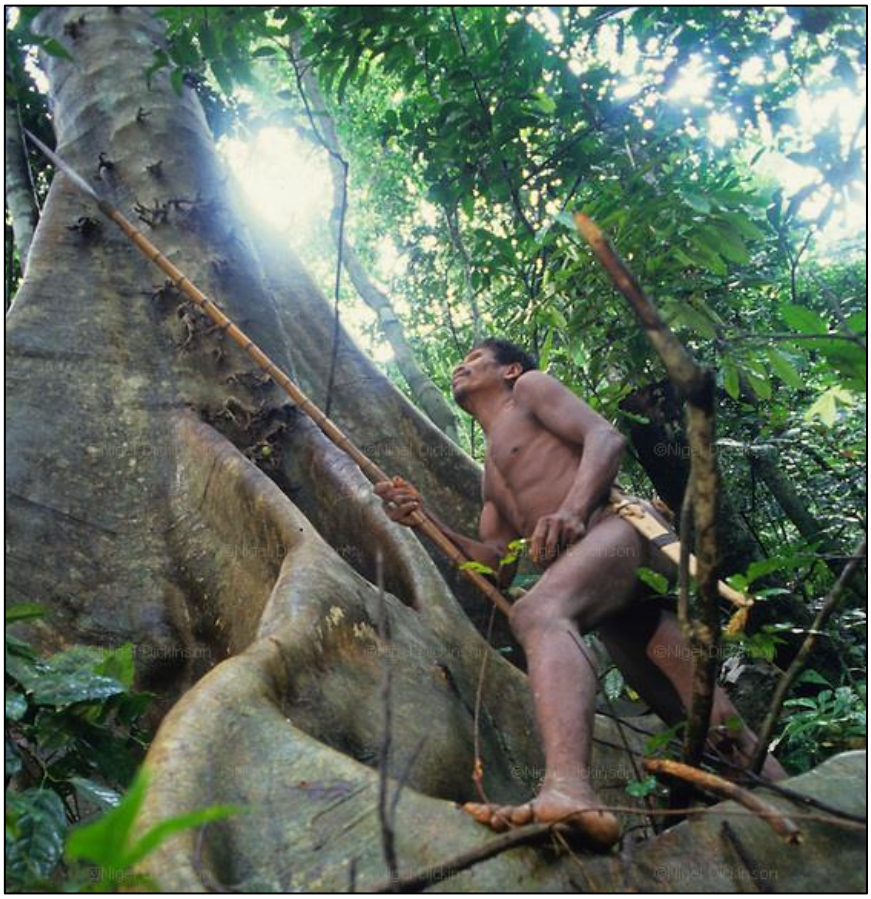


PLATE 5.6. Superior: Batak hunter in the rainforest, performing hunt with spear (Copyright: Nigel Dickinson). Inferior: Batak women planting rice in a burned swidden field (Copyright: Tom Cornelly).

5.5. FUTURE PERSPECTIVES OF THIS LINE OF INVESTIGATION.

For finishing the present work, some ideas or future perspectives related to the facts which were exposed in the main text can be concluded here:

- Since not all the cases of the assemblage studied where sexed or aged with the methods selected, maybe the use of other ways of approximation would be successful: the sex determination methods based on teeth analysis seems plausible for the particular case of Ille, since several cases presented here preserved the dentition (good references about some of this methods can be found in WHITE, FOLKENS, 2005, pp.387); and about the ageing of the individuals, the analysis of the sternal rib end or the radiographic analysis of some bone groups (WHITE, FOLKENS, 2005, pp.381) seem good examples which perfectly could be accomplished in Ille bone assemblage.
- This possibility of sexing and ageing more individuals could be interesting for trying to infer patterns which could relate the presence of paleopathologies and activity markers with sex and age groups.
- Would be interesting also to expand the study about Ille Cave paleopathologies to other chronologies: the comparison of the pathologies registered in the present work with the ones proceeding from the cremation cemetery or a potential study of the colonial phase would give us interesting results from the perspective of the evolution of the health in the population which inhabited Ille in a wide chronological point of view.
- In the same sense, the comparison with the pathologies documented in the sub-adults individuals from Ille would give us new information about this life period, and also would allow us to understand better some pathologies which were presented here (cribra orbitalia, DEH) and which pointed to possible cases of malnutrition during the childhood. Fortunately, the researcher Jessica Peña, from the ASP, is currently working on it, and the results of her master thesis (provisional title: *Taphonomical analysis and bone representation on non-adult individuals of Ille Cave and Rockshelter, Palawan*) will be presented soon.
- Also, for understanding better the activity patterns of Ille archaeological populations, an interesting work is being developed currently in the ASP: the researcher Sarah Agatha Villaluz is currently studying entheseal changes

(musculoskeletal stress markers) and bone cross sectional geometry trough 3D scanning, in order to infer and reconstruct activity patterns of these populations. Her master thesis (provisional title: *Reconstructing physical activity of adults from Ille archaeological site, El Nido, Palawan*) will be presented soon as well.

- Would be also potentially interesting to develop an archaeological-ethnographical based study of the said medicinal plans recovered from the site (section 5.4), in order to understand the use of them and other cases in the current populations of Palawan island and try to understand if actually they where used in prehistoric times, what also would offer an interesting perspective about the conscience of health care in Ille Cave.
- Also, dietary studies could be accomplished in the future trough the skeletal assemblage from Ille. In this sense, since the dental calculus deposits are present in the majority of teeth of the assemblage chosen for the present study, and in some cases these deposits seem to be considerable (although for the present work the quantification of calculus was not accomplished), and since calculus is known to be a really good source of information on paleodietary reconstructions, seems reasonable to take them as an starting point for potential investigations. Their observation with scanning electron microscope (SEM), isotopic analysis or even phytolith analysis (which also would offer information related to paleoenvironment) would definitely offer valuable information about the lifestyle of Ille Cave prehistoric inhabitants.

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ANNEX I

INVENTORY AND BONE DESCRIPTION FILES.

INVENTORY AND BONE DESCRIPTION SHEET.	CONTEXT Nº: 67

- CRANIAL SKELETON:

Bone	**Description**
Frontal	Present, divided into several fragments, including part of the supraorbital margins (big fragment of the left one, small piece of the right one).
Parietal (right)	Present, really fragmented.
Parietal (left)	Present, really fragmented, but includes a big fragment (40% of bone) which includes the suture joint to the left temporal.
Temporal (right)	Present, represented in a big fragment which includes the mastoid process and the acoustic meatus (zygomatic process missing).
Temporal (left)	Present and complete. The extreme of the zygomatic process is separated in another piece.
Auditory ossicles	Missing.
Occipital	Present in some fragments, including one occipital condyle.
Wurmian bones	Missing.
Sphenoid	Missing.
Ethmoid	Missing.
Zygomatic (right)	Present, complete and still connected to the right maxilla.
Zygomatic (left)	Present, disconnected, complete.
Nasal (right)	Missing.
Nasal (left)	Missing.
Nasal concha (right)	Missing.
Nasal concha (left)	Missing.
Lacrimal (right)	Missing.
Lacrimal (left)	Missing.
Palatine (right)	Missing.
Palatine (left)	Missing.
Vomer	Missing.
Maxilla (right)	Present, almost complete (missing part of the frontal process), connected to the right zygomatic bone.
Maxilla (left)	Just represented in some fragments of the alveolar process.
Mandible	Present, fragmented into eight pieces, but still possible to connect them all (complete).
Hyoid	Missing.

- DENTITION (FDI system):

Maxillary right								Maxillary left							
18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Mandibular right								Mandibular left							

- POSTCRANIAL AXIAL SKELETON:

Bone	**Description**
Vertebrae (7 cervical)	Is just preserved a fragment of the vertebral arch of C1 (atlas).
Vertebrae (12 thoracic)	Missing.
Vertebrae (5 lumbar)	Missing.
Ribs (12 right)	Missing.
Ribs (12 left)	Missing.
Sternum	Missing.
Sacrum	Missing.
Coccyx	Missing.

- UPPER LIMB: Missing.
- HANDS: Missing.
- LOWER LIMB: Missing.
- FEET: Missing.

INVENTORY AND BONE DESCRIPTION SHEET.	CONTEXT Nº: 484

- CRANIAL SKELETON: Missing.
- DENTITION (FDI system): Missing.
- POSTCRANIAL AXIAL SKELETON:

Bone	**Description**
Vertebrae (7 cervical)	Just represented in some fragments (a vertebral body and three fragments of spinous process).
Vertebrae (12 thoracic)	All the thoracic vertebrae are also represented, except one. The upper ones (T1-T7) are represented in the vertebral arches (the vertebral bodies are missing in all this cases, except for some fragments still attached to the vertebral arches), except one of them, which seems to be the missing thoracic vertebrae. From T8 to T12, all the thoracic vertebrae are present and perfectly preserved.
Vertebrae (5 lumbar)	L1 is present and complete, L2-L5 are missing (except for some possible body fragments and a vertebral arch, which could be preserved as lumbar cause the lateral projection of the transverse process).
Ribs (12 right)	Just preserved the 12th rib and some fragments of others (including up to three sternal ends).
Ribs (12 left)	All of them are present, but some fragments are missing (normally from the frontal edges, since the heads and the neck are perfectly represented in all cases).
Sternum	Missing.
Sacrum	Missing.
Coccyx	Missing.

- UPPER LIMB:

Bone	**Description**
Scapula (right)	Missing.
Scapula (left)	Present, well preserved, except of some part of the superior border and all the articulation process (glenoid fossa and coracoid process).
Clavicle (right)	Missing.
Clavicle (left)	Missing.
Humerus (right)	Missing.
Humerus (left)	Present, fragmented. The head is separated of the diaphysis and fragmented in several pieces. The proximal part of the diaphysis is represented in several small fragments, and the rest of it (distal 2/3) is well preserved, still in contact with the distal epiphysis, in which is missing the inferior edge (almost all the trochlea and the capitulum).
Ulna (right)	Missing.

Ulna (left)	Missing.
Radius (right)	Missing.
Radius (left)	Missing.

- HANDS: Missing.

- LOWER LIMB:

Bone	**Description**
Pelvis (right)	Missing.
Pelvis (left)	Missing.
Femur (right)	Just two fragments which represent part of the proximal epiphysis (including both the greater and lesser trochanters).
Femur (left)	Missing.
Patella (right)	Missing.
Patella (left)	Missing.
Tibia (right)	A fragment of the diaphysis which includes the section of the anterior crest.
Tibia (left)	Missing.
Fibula (right)	Missing.
Fibula (left)	Missing.

- FEET:

Bone	**Description**
Talus	Present in both feet.
Calcaneus	Present in both feet.
Cuboid	Present just in left foot.
Navicular	Present in both feet.
Medial/1st cuneiform	Present in both feet.
Inter./2nd cuneiform	Present in both feet.
Lateral/3^{d} cuneiform	Present in both feet.
Metatarsals (5x2)	Present: all in both feet.
Prox. phalanges (5x2)	Present: all (5) from left foot.
Inter. phalanges (4x2)	Present: 2 from the left foot.
Dist. phalanges (5x2)	Present: 2 from the left foot.


ILLE CAVE
CONTEXT 484
IFRAO

INVENTORY AND BONE DESCRIPTION SHEET.	CONTEXT Nº: 703

- CRANIAL SKELETON: Missing.
- DENTITION (FDI system): Missing.
- POSTCRANIAL AXIAL SKELETON: Missing.
- UPPER LIMB:

Bone	**Description**
Scapula (right)	Missing.
Scapula (left)	Missing.
Clavicle (right)	Missing.
Clavicle (left)	Missing.
Humerus (right)	Missing.
Humerus (left)	Missing.
Ulna (right)	Present, a fragment which represents around 30% of the bone and which goes from the proximal epiphysis (preserved the ulnar tuberosity and the neck of the epiphysis around it, but missing all the upper part of the articulation) to the diaphysis.
Ulna (left)	Similar to the previous case, but more than half part of the bone is present: preserves more part of the diaphysis, and also more part of the neck in the proximal epiphysis (even if the articulation process and all the olecranon are also missing).
Radius (right)	Missing.
Radius (left)	Present around 30% of the bone, from the medial diaphysis to the proximal epiphysis (the head is missing, but the neck area and the radial/bicipital tuberosity are still present).

- HANDS: Missing.
- LOWER LIMB:

Bone	**Description**
Pelvis (right)	Missing.
Pelvis (left)	Missing.
Femur (right)	Missing.
Femur (left)	Missing.
Patella (right)	Missing.
Patella (left)	Missing.
Tibia (right)	Present, divided into several fragments, which include almost all the diaphysis and part of the proximal epiphysis (from under the tibial tuberosity, which is missing as well as the entire tibial plateau). Also some fragments of the distal epiphysis where documented.
Tibia (left)	Present, divided into several fragments, including almost all the diaphysis and the proximal epiphysis (from the tibial tuberosity: the tibial plateau could be identified in separated fragments).

Fibula (right)	Present in one fragment, which corresponds to almost all the diaphysis and the neck of the proximal epiphysis.
Fibula (left)	Present, divided into three fragments which can be connected, and which represent all the diaphysis and part of the proximal epiphysis (missing the styloid process, but all the neck around it is still present).

- FEET: Missing.


ILLE CAVE
CONTEXT 703
IFRAO 10 cm

INVENTORY AND BONE DESCRIPTION SHEET.	CONTEXT Nº: 727

- CRANIAL SKELETON:

Bone	**Description**
Frontal	Present, divided into several fragments. Preserved part of the orbitae (supraorbital of the right side and interior wall of the left orbit, still connected to the nasal bones).
Parietal (right)	Present, divided into lot of fragments.
Parietal (left)	Present, really fragmented.
Temporal (right)	Missing, except of a fragment of the zygomatic process.
Temporal (left)	Present and quite well preserved. Is missing the upper squama, but good preservation of all the external acoustic meatus, the mastoid process, the suprameatal crest and the zygomatic process (in a separated piece, which is still possible to connect, even with the zygomatic bone of this side.
Auditory ossicles	Missing.
Occipital	Present in some fragments, but all the structure of the foramen magnum is missing.
Wurmian bones	Missing.
Sphenoid	Present, really fragmented.
Ethmoid	Present, fragmented in several small pieces.
Zygomatic (right)	Present, disconnected, complete.
Zygomatic (left)	Present, disconnected, not complete (almost 50% missing).
Nasal (right)	Present, still connected to the left nasal and a fragment of the frontal.
Nasal (left)	Present, connected to the frontal (left orbital side) and the right nasal bone.
Nasal concha (right)	Missing.
Nasal concha (left)	Missing.
Lacrimal (right)	Missing.
Lacrimal (left)	Missing.
Palatine (right)	Missing.
Palatine (left)	Missing.
Vomer	Missing.
Maxilla (right)	Present, connected to the left maxilla. But missing all the palatine internal structure and the nasal and orbital apertures (zygomatic process, frontal process, lacrimal crest).
Maxilla (left)	Present, connected to the right maxilla. But missing all the palatine internal structure and the nasal and orbital apertures (zygomatic process, frontal process, lacrimal crest).
Mandible	Present, fragmented into eight pieces, but still possible to connect them all (complete).
Hyoid	Missing.

- DENTITION (FDI system):

Maxillary right								Maxillary left							
18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Mandibular right								Mandibular left							

- POSTCRANIAL AXIAL SKELETON:

Bone	**Description**
Vertebrae (7 cervical)	At least five of them are present, since the anterior part of four of their vertebral bodies are present (vertebral process fragments are preserved, but is not possible to reconstruct and individualize this vertebrae), plus the axis, which is complete (including the odontoid process). Atlas hasn´t been identified.
Vertebrae (12 thoracic)	Present, but really fragmented, can´t be reconstructed (impossible to determine the exact number). At least five spinous process are present, plus some fragments of transverse process and periferical parts of the vertebral bodies.
Vertebrae (5 lumbar)	Present, really fragmented, like in the previous cases, but the presence of the typical morphology of the transverse process of this group (posterior view) allows us to determine that all the lumbar vertebrae are represented.
Ribs (12 right)	Present, really fragmented. The first rib is complete, but the rest of them are totally disconnected. Preserved the heads (articulation with the column) of at least another eight cases. The sternal ends are missing.
Ribs (12 left)	Present, really fragmented. Preserved the head of six of them. A group of 5 ribs fragments was recovered cemented over a shell during the excavation, so is still possible to see them in their original position, connected with the sediment.
Sternum	Missing.
Sacrum	Present, fragmented in several small pieces. The only recognizable parts (bigger fragments) correspond to the ventral arc (including the transverse lines), the dorsal Wall (including the medial crest) and the right sacroiliac joint (auricular surface).
Coccyx	Missing.

- UPPER LIMB:

Bone	**Description**
Scapula (right)	Present, just some fragments preserved (glenoid fossa connected to the acromion, inferior angle, and some fragments of the wing).
Scapula (left)	Present, but just some fragments (mainly some parts of the lateral border and the glenoid fossa).
Clavicle (right)	Present, fragmented in three pieces. Remains the articulation with the acromial process of the scapula, but not the sternal articulation.
Clavicle (left)	Present, divided in two pieces (medial part of its body). Missing fragments in both its extremes (articulations with sternum and

	scapula).
Humerus (right)	Present, fragmented in three pieces. The head of the humerus (articulation with scapula) is separated, and the bone is also fragmented around the middle the diaphysis.
Humerus (left)	Present, once again fragmented in three pieces (head separated and divided in the middle diaphysis, like in the case of the opposite limb). In this case the distal epiphysis is also missing.
Ulna (right)	Present, fragmented in three pieces (broken twice around the distal diaphysis).
Ulna (left)	Present, also fragmented like in the opposite limb (three pieces, distal diaphysis), but in this case the distal epiphysis is also missing.
Radius (right)	Present, divided in four fragments: three of them which connect the proximal epiphysis and the diaphysis, and a separated one which correspond to the distal epiphysis (articulation with the hand). Unfortunately a fragment of the diaphysis, the one which connects the epiphysis with the rest of the bone, is missing.
Radius (left)	Present, fragmented twice along the diaphysis (in three pieces of similar dimensions). The distal epiphysis is missing in this side.

- HANDS:

Bone	**Description**
Scaphoid	Present in both hands.
Lunate	Present in right hand.
Triquetrum	Present in left hand.
Trapezium	Present in both hands.
Trapezoid	Present in right hand.
Capitate	Present in both hands.
Pisiform	Missing in both hands.
Hamate	Present in both hands.
Metacarpals (5x2)	Fragmented in both hands. Present: five of the left side, four of the right one.
Prox. phalanges (5x2)	Fragmented, but present: at least two in the left hand, four in the right hand.
Inter. phalanges (4x2)	Present: two in the left side and four from the right hand.
Dist. phalanges (5x2)	Present: three from the left hand and four from the right hand.

- LOWER LIMB:

Bone	**Description**
Pelvis (right)	Present, fragmented in several pieces. Preserved half size of the acetabulum, extending till the beginning of the ischial tuberosity, which surface is also missing. Also present (in two separated fragments) the ischiopubic ramus. The ilium blade is preserved in the posterior/gluteal part, and another fragment represents a big part of the iliac crest, till his frontal limit. The central and anterior part of the ilium is also missing.
Pelvis (left)	Present, fragmented in several pieces. Is preserved the area around the acetabulum (with a missing part of its edge, but preserves half

	part of the lunate surface) together with a part of the inferior ilium surface (plus some small fragments)and a separated piece which corresponds to its superior edge (part of the iliac crest).
Femur (right)	Missing.
Femur (left)	Present, fragmented in two pieces (around middle diaphysis). Missing parts: distal epiphysis, part of the proximal epiphysis (between the intertrochanteric crest and the lesser trochanter), part of the inferior edge of the head.
Patella (right)	Missing.
Patella (left)	Missing.
Tibia (right)	Missing.
Tibia (left)	Missing.
Fibula (right)	Missing.
Fibula (left)	Missing.

- FEET: Missing.


ILLE CAVE
CONTEXT 727

INVENTORY AND BONE DESCRIPTION SHEET.	CONTEXT Nº: 755

- CRANIAL SKELETON:

Bone	**Description**
Frontal	Present, complete. Still possible to connect with both parietals.
Parietal (right)	Present, complete. Divided in two fragments: the bigger one (in which is just missing the posterior edge, between the mastoid angle and the occipital angle), separated of any other bone, and the missing fragment, still attached to the occipital bone.
Parietal (left)	Present, complete. Still possible to connect with the opposite parietal and the frontal bone.
Temporal (right)	Present, almost complete (missing just a small fragment of the superior-posterior edge). Divided in three main pieces: the main body of the bone, the fragmented zygomatic process and a separated fragment of flat bone from the superior edge.
Temporal (left)	Present, complete. Divided in three fragments: the articular eminence is separated of the rest of the bone, and also the zygomatic process is fragmented in another piece.
Auditory ossicles	Missing.
Occipital	Present, fragmented into four pieces. Is not complete: missing the frontal edge of the foramen magnum (preserved the half posterior edge of it, together with both the occipital condyles, in two separated fragments). Part of the bone is still attached to some fragments of the right parietal.
Wurmian bones	Missing.
Sphenoid	Possibly present in small fragments.
Ethmoid	Possibly present in small fragments.
Zygomatic (right)	Present, complete, still connected to the right maxilla.
Zygomatic (left)	Present, complete.
Nasal (right)	Superior half part of it conserved and connected to the superior half part of the opposite nasal bone.
Nasal (left)	Superior half part of it conserved and connected to the superior half part of the opposite nasal bone.
Nasal concha (right)	Missing.
Nasal concha (left)	Missing.
Lacrimal (right)	Missing.
Lacrimal (left)	Missing.
Palatine (right)	Missing.
Palatine (left)	Missing.
Vomer	Missing.
Maxilla (right)	Present, complete, connected to the right zygomatic.
Maxilla (left)	Just a fragment which includes the infraorbital foramen.
Mandible	Present, complete, divided in two fragments.
Hyoid	Missing.

- DENTITION (FDI system):

Maxillary right								Maxillary left							
-	17	16	15	14	-	-	-	-	-	-	-	-	-	-	-
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Mandibular right								Mandibular left							

- POSTCRANIAL AXIAL SKELETON:

Bone	**Description**
Vertebrae (7 cervical)	Present, all of them, including atlas and axis. All of them really well preserved (just some small fragments missing, normally around the pedicles). C7 is the only one with a worst conservation status: missing almost all the vertebral arch, except part of the transverse process and both the superior articular facets.
Vertebrae (12 thoracic)	Missing.
Vertebrae (5 lumbar)	Missing.
Ribs (12 right)	Missing.
Ribs (12 left)	Missing.
Sternum	Missing.
Sacrum	Missing.
Coccyx	Missing.

- UPPER LIMB:

• **Bone**	**Description**
Scapula (right)	Missing.
Scapula (left)	Missing.
Clavicle (right)	Present, missing both epiphyses.
Clavicle (left)	Missing.
Humerus (right)	Missing.
Humerus (left)	Missing.
Ulna (right)	Missing.
Ulna (left)	Missing.
Radius (right)	Missing.
Radius (left)	Missing.

- HANDS: Missing.
- LOWER LIMB: Missing.
- FEET: Missing.


ILLE CAVE
CONTEXT 755
IFRAO

INVENTORY AND BONE DESCRIPTION SHEET.	CONTEXT Nº: 800

- CRANIAL SKELETON: Missing.

Bone	**Description**
Frontal	Present, divided into several fragments. Preserves part of the left orbitae (supraorbital of the right side and interior wall of the left orbit.
Parietal (right)	Present, divided into lot of fragments.
Parietal (left)	Present, really fragmented.
Temporal (right)	Just preserved a fragment of the zygomatic process.
Temporal (left)	Missing.
Auditory ossicles	Missing.
Occipital	Missing.
Wurmian bones	Missing.
Sphenoid	Small fragment.
Ethmoid	Missing.
Zygomatic (right)	Missing.
Zygomatic (left)	A fragment is present.
Nasal (right)	The upper part of it is still connected to the opposite nasal and the frontal bone.
Nasal (left)	The upper part of it is still connected to the opposite nasal and the frontal bone.
Nasal concha (right)	Missing.
Nasal concha (left)	Missing.
Lacrimal (right)	Missing.
Lacrimal (left)	Missing.
Palatine (right)	Missing.
Palatine (left)	Missing.
Vomer	Missing.
Maxilla (right)	Some small fragments of the alveolar process around the molars.
Maxilla (left)	Some small fragments of the alveolar process around the molars.
Mandible	Present, fragmented into three pieces: both sides of the mandibular body (missing the mental area) and the left mandibular condyle.
Hyoid	Missing.

- DENTITION (FDI system):

Maxillary right								Maxillary left							
18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41	31	32	-	-	35	36	37	38
Mandibular right								Mandibular left							

- POSTCRANIAL AXIAL SKELETON:

Bone	**Description**
Vertebrae (7 cervical)	Really fragmented. Just possible to identify clearly some vertebral arches and possible body fragments.
Vertebrae (12 thoracic)	Really fragmented. Some fragments of vertebral bodies and transverse process.
Vertebrae (5 lumbar)	Missing.
Ribs (12 right)	Present, really fragmented. Possible to identify up to 4 rib heads and a sternal ending.
Ribs (12 left)	Present, really fragmented. Possible to identify up to 3 rib heads.
Sternum	A fragment is present, in which we can observe the section of a costal notch.
Sacrum	Missing.
Coccyx	Missing.

- UPPER LIMB:

Bone	**Description**
Scapula (right)	Missing.
Scapula (left)	A fragment of the glenoid fossa and the acromion is present, plus another one which represents a small portion of the lateral border.
Clavicle (right)	Just a fragment of the diaphysis in which we can observe the subclavian sulcus.
Clavicle (left)	Just a fragment of the sternal end.
Humerus (right)	Just preserved the distal epiphysis, divided in two fragments.
Humerus (left)	Present, fragmented. The head is separated of the diaphysis. The rest of the bone, the diaphysis, is connected to the distal epiphysis, in which is missing just the lateral epicondyle.
Ulna (right)	Just present a fragment which includes the proximal part of the diaphysis and the proximal epiphysis (the upper part of the articulation is missing, from half part of the guiding ridge to top).
Ulna (left)	Similar case of the right ulna, but in this case all the proximal epiphysis is missing (although we can observe the start of its neck).
Radius (right)	Present, complete.
Radius (left)	Preserved a fragment which includes the proximal epiphysis and around half part of the diaphysis.

- HANDS:

Bone	**Description**
Scaphoid	Present in both hands.
Lunate	Present in right hand.
Triquetrum	Present in left hand.
Trapezium	Present in both hands.
Trapezoid	Present in right hand.
Capitate	Present in left hand.
Pisiform	Missing in left hand.
Hamate	Present in left hand.
Metacarpals (5x2)	Present: four in each hand.

Prox. phalanges (5x2)	Present: 3 in the left hand and 2 in the right side.
Inter. phalanges (4x2)	Present: 3 in the left hand and 4 in the right hand.
Dist. phalanges (5x2)	Present: 4 pieces (difficult siding).

- LOWER LIMB:

Bone	**Description**
Pelvis (right)	Missing.
Pelvis (left)	Missing.
Femur (right)	Present, divided into several fragments. All the neck and the greater trochanter are missing (but preserved separated fragment of the head), and also half part of the distal epiphysis.
Femur (left)	Present, divided into several fragments. Is missing the greater trochanter and part of the neck and the head.
Patella (right)	Present, complete.
Patella (left)	Present, complete.
Tibia (right)	Present, divided into several fragments. The distal epiphysis is missing, and also half part of the tibial plateau.
Tibia (left)	Present, divided into several fragments. In this case is just missing the distal epiphysis (the proximal one is complete, but damaged).
Fibula (right)	All the diaphysis is present, together with the distal neck, but fragmented in four portions.
Fibula (left)	Some fragments of the diaphysis and the proximal epiphysis, with no possible connection between them.

- FEET:

Bone	**Description**
Talus	Present in both feet.
Calcaneus	Present in right foot.
Cuboid	Present in right foot.
Navicular	Present in right foot.
Medial/1st cuneiform	Present in right foot.
Inter./2nd cuneiform	Present in right foot.
Lateral/3^{d} cuneiform	Present in right foot.
Metatarsals (5x2)	Present in right foot.
Prox. phalanges (5x2)	Present: 4 of the right foot.
Inter. phalanges (4x2)	Present: 1 of the right foot.
Dist. phalanges (5x2)	Present: 2 from the right foot.

INVENTORY AND BONE DESCRIPTION SHEET.	CONTEXT Nº: 907

- CRANIAL SKELETON:

Bone	**Description**
Frontal	Missing.
Parietal (right)	Missing.
Parietal (left)	Missing.
Temporal (right)	Missing.
Temporal (left)	Missing.
Auditory ossicles	Missing.
Occipital	Missing.
Wurmian bones	Missing.
Sphenoid	Missing.
Ethmoid	Missing.
Zygomatic (right)	Missing.
Zygomatic (left)	Missing.
Nasal (right)	Missing.
Nasal (left)	Missing.
Nasal concha (right)	Missing.
Nasal concha (left)	Missing.
Lacrimal (right)	Missing.
Lacrimal (left)	Missing.
Palatine (right)	Missing.
Palatine (left)	Missing.
Vomer	Missing.
Maxilla (right)	Present around 50%, including the inferior edge (alveolar surface).
Maxilla (left)	Present, around 50%, inferior edge an alveolar surface with some teeth.
Mandible	Present, fragmented in three pieces.
Hyoid	Missing.

- DENTITION (FDI system):

Maxillary right								Maxillary left							
-	17	16	15	14	13	-	-	21	22	23	-	25	-	27	-
48	47	46	-	-	-	-	-	-	-	-	-	-	-	37	38
Mandibular right								Mandibular left							

- POSTCRANIAL AXIAL SKELETON: Missing.

- UPPER LIMB:

Bone	Description
Scapula (right)	Missing.
Scapula (left)	Missing.
Clavicle (right)	Missing.
Clavicle (left)	Missing.
Humerus (right)	Missing.
Humerus (left)	Present just some fragments which represent the distal epiphysis and part of the distal diaphysis.
Ulna (right)	Missing.
Ulna (left)	Present, some fragments of the diaphysis.
Radius (right)	Missing.
Radius (left)	Missing.

- HANDS: Missing.

- LOWER LIMB:

Bone	Description
Pelvis (right)	Missing.
Pelvis (left)	Just preserved a small fragment which includes part of the sacro-iliac joint. Almost all the auricular surface of the ilium is preserved.
Femur (right)	Missing.
Femur (left)	Missing.
Patella (right)	Missing.
Patella (left)	Missing.
Tibia (right)	Missing.
Tibia (left)	Missing.
Fibula (right)	Missing.
Fibula (left)	Missing.

- FEET: Missing.


IFRAO
ILLE CAVE
CONTEXT 907

INVENTORY AND BONE DESCRIPTION SHEET.	CONTEXT Nº: 1337

- CRANIAL SKELETON:

Bone	**Description**
Frontal	Present, almost complete (missing the superior edge).
Parietal (right)	Present, divided into several fragments.
Parietal (left)	Present, divided into several fragments.
Temporal (right)	Present, almost complete. The superior edge is fragmented in two extra pieces, and part of it is missing. The zygomatic process is also fragmented; the mastoid process is well preserved.
Temporal (left)	Present around 50%. All the flat surface of the bone (part of the cranial vault) is missing, and also the zygomatic process. The mastoid process is present.
Auditory ossicles	Missing.
Occipital	Present, fragmented into several pieces. Is present the nucal crest and a small part of the edge of the foramen magnum. Both the occipital condyles are missing.
Wurmian bones	Missing.
Sphenoid	Missing.
Ethmoid	Present in small fragments.
Zygomatic (right)	Present, complete, still connected to the right maxilla.
Zygomatic (left)	Missing.
Nasal (right)	Present.
Nasal (left)	Present.
Nasal concha (right)	Missing.
Nasal concha (left)	Missing.
Lacrimal (right)	Missing.
Lacrimal (left)	Missing.
Palatine (right)	Missing.
Palatine (left)	Missing.
Vomer	Missing.
Maxilla (right)	Present, complete.
Maxilla (left)	Just a fragment.
Mandible	Present, complete. The ascending ramus of the left side is broken.
Hyoid	Missing.

- DENTITION (FDI system):

Maxillary right								Maxillary left							
-	-	-	-	14	13	12	-	21	-	23	-	-	-	-	-
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Mandibular right								Mandibular left							

- POSTCRANIAL AXIAL SKELETON:

Bone	Description
Vertebrae (7 cervical)	Present. Atlas and axis are complete. The rest of them really fragmented, still possible to identify some vertebral bodies.
Vertebrae (12 thoracic)	Represented through several fragments. Possible to identify some fragments of vertebral bodies and some process.
Vertebrae (5 lumbar)	Missing.
Ribs (12 right)	Present, really fragmented. Possible to identify fragments of the ribs 1-8, 10 and 12.
Ribs (12 left)	Present really fragmented. Possible to identify fragments from the ribs 1-6.
Sternum	A Part of the corpus sterni is present.
Sacrum	Missing.
Coccyx	Missing.

- UPPER LIMB:

• **Bone**	**Description**
Scapula (right)	Present, really fragmented. Preserved the glenoid cavity.
Scapula (left)	Present, very fragmented. Still remains the glenoid fossa.
Clavicle (right)	Present, divided in two fragments, missing both epiphyses.
Clavicle (left)	Present, missing both epiphyses.
Humerus (right)	Present, both epiphysis are broken into several fragments.
Humerus (left)	Present. The proximal epiphysis is represented in a couple of fragments, but the distal one is missing.
Ulna (right)	Missing.
Ulna (left)	Missing.
Radius (right)	Missing.
Radius (left)	A fragment of its diaphysis is present.

- HANDS: Missing.
- LOWER LIMB: Missing.
- FEET: Missing.


IFRAO 10 cm
ILLE CAVE
CONTEXT 1337

INVENTORY AND BONE DESCRIPTION SHEET.	CONTEXT Nº: 1825

- CRANIAL SKELETON:

Bone	**Description**
Frontal	Present, divided into several fragments. One of them still configures the shape of the glabela and the orbitae, still connected to the nasal bones.
Parietal (right)	Present, fragmented.
Parietal (left)	Present, fragmented.
Temporal (right)	Missing.
Temporal (left)	Missing.
Auditory ossicles	Missing.
Occipital	Missing.
Wurmian bones	Missing.
Sphenoid	Missing.
Ethmoid	Missing.
Zygomatic (right)	Missing.
Zygomatic (left)	Missing.
Nasal (right)	Present, still connected to the left nasal and a fragment of the frontal.
Nasal (left)	Present, connected to the frontal (left orbital side) and the right nasal bone.
Nasal concha (right)	Missing.
Nasal concha (left)	Missing.
Lacrimal (right)	Missing.
Lacrimal (left)	Missing.
Palatine (right)	Missing.
Palatine (left)	Missing.
Vomer	Missing.
Maxilla (right)	Present around 25%, just the area immediate to the teeth.
Maxilla (left)	Present, around 15%, surroundings of the teeth.
Mandible	Present, around 30%, fragmented into several pieces, but still possible to connect some of them. Mainly represented the mental area and the body of the left side, including the mental foramen of this side. The ascending ramus is missing in both sides.
Hyoid	Missing.

- DENTITION (FDI system):

Maxillary right								Maxillary left							
18	17	16	15	14	13	12	11	21	22	23	-	-	-	27	-
-	47	-	-	44	43	42	41	31	-	-	34	35	36	37	38
Mandibular right								Mandibular left							

- POSTCRANIAL AXIAL SKELETON:

Bone	**Description**
Vertebrae (7 cervical)	Missing.
Vertebrae (12 thoracic)	Missing.
Vertebrae (5 lumbar)	Just preserved two vertebral bodies and three fragments of vertebral arches. The conservation status doesn´t allow us to identify which of the lumbar vertebrae (L1-5) we have, and the pieces have not possible connection between them.
Ribs (12 right)	Missing.
Ribs (12 left)	Just documented three small fragments which can´t be sided, plus one from the left side.
Sternum	Missing.
Sacrum	Present around 25%, fragmented in several pieces. Just possible to recognize a fragment of the sacroiliac joint (not sided) and a fragment of the ventral wall, which includes part of the perimeter of a sacral foramen.
Coccyx	Missing.

- UPPER LIMB:

Bone	**Description**
Scapula (right)	Just a fragment corresponding to the coracoid process.
Scapula (left)	Missing.
Clavicle (right)	Present, fragmented in two pieces. Both the sternal and acromial articulations are missing.
Clavicle (left)	Missing.
Humerus (right)	Missing.
Humerus (left)	Present, fragmented in five pieces. Missing the head (articulation with scapula) and almost all the distal epiphysis.
Ulna (right)	Preserved just the proximal epiphysis (articulation with the humerus, guiding ridge).
Ulna (left)	Missing.
Radius (right)	Present, divided in several fragments, without both epiphysis.
Radius (left)	Present, divided in several fragments, missing both epiphysis.

- HANDS:

Bone	**Description**
Scaphoid	Missing.
Lunate	Missing.
Triquetrum	Missing.
Trapezium	Missing.
Trapezoid	Missing.
Capitate	Missing.
Pisiform	Missing.
Hamate	Missing.
Metacarpals (5x2)	Preserved fragments of three of them, but not possible to side them.
Prox. phalanges (5x2)	Two of them preserved.
Inter. phalanges (4x2)	Four of them preserved.
Dist. phalanges (5x2)	One preserved.

- LOWER LIMB:

Bone	**Description**
Pelvis (right)	Missing.
Pelvis (left)	Missing.
Femur (right)	Present, fragmented into several pieces. Both epiphysis are missing. The media diaphysis is represented by two main fragments, wich correspond to a healed fracture. Other fragments of the rest of the diaphysis.
Femur (left)	Present, fragmented in four sections. Both epiphysis are missing (just remains the fragmented diaphysis).
Patella (right)	Present, but quite difficult to identify (missing shape).
Patella (left)	Present, easier to distinguish than in the opposite side, since preserves the angle between both the posterior articular facets (medial and lateral).
Tibia (right)	Present, divided in two big fragments and several small ones. Both epiphyses are missing.
Tibia (left)	Present a big fragment of the diaphysis and a small fragment of the distal epiphysis.
Fibula (right)	Missing.
Fibula (left)	Missing.

- FEET: Missing.


ILLE CAVE
CONTEXT 1825
IFRAO

INVENTORY AND BONE DESCRIPTION SHEET.	CONTEXT Nº: 2240

- CRANIAL SKELETON: Missing.
- DENTITION (FDI system): Missing.
- POSTCRANIAL AXIAL SKELETON:

Bone	**Description**
Vertebrae (7 cervical)	Four of them are represented: two of them just preserved the vertebral arches, another one preserves the vertebral arch and part of the vertebral body, and the last one is the C2 (axis). Atlas (C1) is missing.
Vertebrae (12 thoracic)	Missing.
Vertebrae (5 lumbar)	A complete lumbar vertebrae is preserved, but we can´t identify which one is it exactly (order).
Ribs (12 right)	At least 8 of them are represented in several fragments, including the second rib.
Ribs (12 left)	At least 6 of them are represented in several fragments, including the first and third ones.
Sternum	Missing.
Sacrum	Missing.
Coccyx	Missing.

- UPPER LIMB:

Bone	**Description**
Scapula (right)	Present (around 40%), remains the part between the half superior border and the infraglenoid tubercle. The coracoid process and part of the acromion are missing, as well as part of the edge of the glenoid fossa.
Scapula (left)	Present, around 30%, similar preservation that the right scapula, but in this case the coracoid process is present.
Clavicle (right)	Missing.
Clavicle (left)	Missing.
Humerus (right)	Present, fragmented. The head is represented in several fragments. The diaphysis and the distal epiphysis are still connected, but the lateral epicondyle and the capitulum are damaged.
Humerus (left)	Present, similar conservation status that the right humerus, but in this case the distal epiphysis is intact.
Ulna (right)	Present and complete.
Ulna (left)	Present, really fragmented. Preserved a fragment which includes the distal epiphysis (complete), another one with the proximal one (missing the olecranon process and half part of the guiding ridge), and several small fragments of the diaphysis.
Radius (right)	Present and complete.
Radius (left)	Present and complete.

- HANDS: Missing.

- LOWER LIMB:

Bone	**Description**
Pelvis (right)	Present around 40%, includes a big fragment around the acetabular fossa, part of the ischial tuberosity and the start of the greater sciatic notch. Another big fragment of the alae (without the superior edge). Missing both the ischiopubic ramus (and pubic symphysis), and also the sacroiliac joint (with the auricular surface of ilium).
Pelvis (left)	Missing.
Femur (right)	Missing.
Femur (left)	Missing.
Patella (right)	Missing.
Patella (left)	Missing.
Tibia (right)	Missing.
Tibia (left)	Missing.
Fibula (right)	Missing.
Fibula (left)	Missing.

- FEET: Missing.


ILLE CAVE
CONTEXT 2240
IFRAO

INVENTORY AND BONE DESCRIPTION SHEET.	CONTEXT Nº: 2247

- CRANIAL SKELETON:

Bone	**Description**
Frontal	Present, complete and still connected to the parietal bones and the splanchnocranium.
Parietal (right)	A fragment of the left parietal is still connected to the opposite parietal and the frontal bones. Preserved around 30%.
Parietal (left)	Preserved around 50%, still connected to the frontal bone and the left parietal.
Temporal (right)	Missing.
Temporal (left)	Just preserved a small fragment of the zygomatic process, still in connection with the zygomatic bone.
Auditory ossicles	Missing.
Occipital	Missing.
Wurmian bones	Missing.
Sphenoid	Missing.
Ethmoid	A fragment is still connected to the posterior part of the wall of the right orbit.
Zygomatic (right)	Present, complete, connected to the rest of bones of the face.
Zygomatic (left)	Present, complete, connected to the rest of bones of the face.
Nasal (right)	Present, complete, connected to the rest of bones of the face.
Nasal (left)	Present, complete, connected to the rest of bones of the face.
Nasal concha (right)	Missing.
Nasal concha (left)	Missing.
Lacrimal (right)	Present, complete, connected to the orbit.
Lacrimal (left)	Present, complete, connected to the orbit.
Palatine (right)	Present, complete, connected.
Palatine (left)	Present, complete, connected.
Vomer	Partially preserved, still connected to the nasal bones.
Maxilla (right)	Present, complete, and connected to the rest of the splanchnocranium.
Maxilla (left)	Present, complete, and connected to the rest of the splanchnocranium.
Mandible	Present, complete.
Hyoid	Missing.

- DENTITION (FDI system):

Maxillary right								Maxillary left							
-	-	-	-	-	-	-	11	21	-	-	-	-	-	-	-
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Mandibular right								Mandibular left							

- POSTCRANIAL AXIAL SKELETON:

Bone	**Description**

Vertebrae (7 cervical)	All the cervical vertebrae are represented. The atlas (C1) is present, but just the vertebral arch, and in the case of the axis (C2) just appeared a fragment corresponding to the vertebral body and the odontoid process. C3 and C4 are also present and almost complete (except of a small fragment of the transverse process in both cases). Finally, C5-C7 are all represented but really fragmented.
Vertebrae (12 thoracic)	All the thoracic vertebrae are also represented. From T1-3 was preserved the complete vertebral arches, excluding the left transverse process in the three of them. None of the vertebral bodies from T1-3 where found. In the case of T4, a fragment of the vertebral body is still preserved together with the vertebral arch, which in this case has lost the spinous process. T5 repeats the conservation status from T1-3, but in this case the missing transverse process is the right one. T6-7 and T9 present the complete vertebral arch still together with fragments of the vertebral bodies. T8 instead just preserves the frontal edge of the vertebral body and the right transverse process. T10 and T11 preserves complete the vertebral body and almost all the complete vertebral arch. Finally, T12 misses almost all the vertebral arch (just preserved a fragment of the right transverse process), but preserved all the external edges of the vertebral body (which central part is also missing).
Vertebrae (5 lumbar)	All of them are present and complete, in quite a good conservation status.
Ribs (12 right)	All of them are present, but some fragments are missing (normally from the frontal edges, since the heads and the neck are perfectly represented in all cases).
Ribs (12 left)	All of them are present, but some fragments are missing (normally from the frontal edges, since the heads and the neck are perfectly represented in all cases).
Sternum	Missing.
Sacrum	Present, almost complete. Well preserved.
Coccyx	Missing.

- UPPER LIMB:

Bone	**Description**
Scapula (right)	Preserved a big fragment which represents around the 30% of the total bone. Is preserved all the area around the articulation with the arm (including the acromion, the glenoid fossa and the infraglenoid tubercle and the scapular neck), but not the coracoid process.
Scapula (left)	Similar case to the previous one, but in this case is missing the inferior half part of the glenoid cavity and a big part of the scapular neck.
Clavicle (right)	Present, really well preserved, except the sternal articulation surface.
Clavicle (left)	Present, really well preserved, except the sternal articulation surface.

Humerus (right)	Present. The head of the bone is separated in a different fragment, and also the medial side of the distal epiphysis (from half part of the trochlea till the medial supracondylar crest, including all the medial epicondyle). The lateral epiphysis is missing.
Humerus (left)	Same conservation status than the one observed for the right humerus, but in this case is missing all the distal epiphysis from the medial supracondylar edge.
Ulna (right)	Present, divided in two fragments, but all the proximal epiphysis is missing.
Ulna (left)	Present, almost complete. Fragmented in the proximal epiphysis, which is preserved in a separated fragment. The tissue around the area is so damaged that is impossible to connect both pieces again.
Radius (right)	Present, almost complete, but the proximal epiphysis is missing (except of a small fragment of the head, which was recovered).
Radius (left)	Present, but just the diaphysis (both epiphysis are missing).

- HANDS:

Bone	**Description**
Scaphoid	Present in both hands.
Lunate	Present in right hand.
Triquetrum	Present in both hands.
Trapezium	Present in both hands.
Trapezoid	Present in both hands.
Capitate	Present in both hands.
Pisiform	Present in both hands.
Hamate	Present in both hands.
Metacarpals (5x2)	Missing.
Prox. phalanges (5x2)	Present: 4 in the right hand and 1 in the left one
Inter. phalanges (4x2)	All present in both hands.
Dist. phalanges (5x2)	Present: 4 from the left hand and 3 from the right hand.

- LOWER LIMB:

Bone	**Description**
Pelvis (right)	Present, well preserved. Just missing fragments in the posterior iliac spine (affecting to the auricular surface of the ilium, which is partially missing), the iliac crest, the ischial tuberosity and the proximal edge of the ischiopubic ramus.
Pelvis (left)	Present, badly preserved. Just recovered three fragile fragments, which together delimitate the area around the alae and the greater sciatic notch, together with the internal edge of the auricular surface of the ilium.
Femur (right)	Present, just missing the distal epiphysis.
Femur (left)	Present, almost complete: missing the distal epiphysis and the greater trochanter.
Patella (right)	Missing.
Patella (left)	Missing.
Tibia (right)	Present. Is missing the proximal epiphysis and the medial part of the distal epiphysis.
Tibia (left)	Present. Missing all the proximal epiphysis and some small

	fragments of the articular surface with the foot.
Fibula (right)	Present, just missing part of the proximal-medial edge the proximal epiphysis.
Fibula (left)	Present, missing the lateral part of the distal epiphysis and the complete proximal epiphysis.

- FEET:

Bone	**Description**
Talus	Missing.
Calcaneus	Missing.
Cuboid	Present in right foot.
Navicular	Present in right foot.
Medial/1st cuneiform	Missing.
Inter./2nd cuneiform	Present in left foot.
Lateral/3^{d} cuneiform	Missing.
Metatarsals (5x2)	Present: 3 in the right foot and 5 in the left one.
Prox. phalanges (5x2)	Present: 3 in the right foot and 3 in the left one.
Inter. phalanges (4x2)	Present: 1 of the right foot.
Dist. phalanges (5x2)	Present: 1 from the left foot.


ILLE CAVE
CONEXT 2247

ANNEX II

SEX AND AGE DETERMINATION FILES.

BIOLOGICAL PROFILE I (SEX AND AGE).	CONTEXT Nº: 67

- SEX DETERMINATION:

Method of the cranial and pelvis morphologies (BUIKSTRA, UBELAKER; 1994):

CRANIAL FEATURES	FEMININE	MASCULINE
Profile of the supraorbital ridge/glabella	(Not determinable)	
Inclination of the frontal bone	(Not determinable)	
Prognatism	(Not determinable)	
Frontal eminences (bosses)	(Not determinable)	
Temporal eminences (bosses)	(Not determinable)	
Superciliary arches	(Not determinable)	
Orbital outline (shape)		**X**
Supraorbital margin (section)		**X**
Zygomatic bone		**X**
Mastoid process		**X**
Suprameatal/supramastoid crest	**X**	
External occipital protuberance	(Not determinable)	
Occipital condyles	(Not determinable)	
Palate	(Not determinable)	
Nuchal crest	Not determinable)	
Mental eminence		**X**
Inferior edge of the mandible		**X**
Gonial angle of the mandible		**X**
Ascending ramus (mandible)	**X**	

Since the pelvic griddle is missing in this case, and we can just observe some features of the cranial remains, which mainly pointed to masculine characteristics (7/9 masculine vrs. 2/9 feminine), we conclude that we´re facing a **MASCULINE INDIVIDUAL**.

- AGE DETERMINATION:

Method of the epiphyseal closure (MCKERN, STEWARD; 1957): Not applicable (all the epiphyses used in this method are missing).

Method of the cranial suture closure (MEINDL, LOVEJOY; 1985): Not applicable (sutures are all disconnected and so fragmented that the cranial vault can´t be reconstructed).

Method of the dental eruption development (UBELAKER; 1989): The third molars from the maxilla have already erupted, and so does the one of the right side of the mandible. The one of the left mandibular side, instead, seems not yet erupted: the root is still growing (we can see the cut in the apical extreme of it, not yet developed), and the alveolar surface of the mandible shows how the dental piece would fix in an intermediate grown position. Also, no calculus is shown yet in this dental piece (the only, possibly cause was still half-hidden). According to the method, this would include

the individual in an age interval between 15+/-3 years old (when the roots start growing) and 21 years old (when the molar has already erupted), so a SUBADULT individual or a YOUNG ADULT in its first years. Taking in account that all the other molars are already erupted, and that this one almost should be as well (root almost complete, ascending position in the mandible of the piece, etc), we would point more to the second case, with an age or circa 21 years old.

Method of the dental wear analysis (BROTHWELL; 1981): The enamel of M1 and M2 is starting to be affected, starting to appear flat surfaces over the crowns, but M3 seems still intact in both mandibular and maxillary sides. Also, the dentine is not appearing in any of the molar pieces. According to Brothwell, this wear pattern could determine an age of 17-25 years old, so it points to a YOUNG/SUBADULT-YOUNG ADULT individual.

Method of the pubic simphyseal surface (SUCHEY, BROOKS; 1990): Not applicable (pelvic griddle is missing).

Method of the auricular surface of the ilium (LOVEJOY *et al.*; 1985): Not applicable (pelvic griddle is missing).

We can conclude than the age rate of the context 67 individual of Ille Cave corresponds to a **YOUNG ADULT** individual, possibly of around 21 years old, so an individual which possibly just left the puberty behind.

BIOLOGICAL PROFILE I (SEX AND AGE).	CONTEXT Nº: 484

- SEX DETERMINATION:

Method of the cranial and pelvis morphologies (BUIKSTRA, UBELAKER; 1994):

Since both the skull and the pelvic griddle are missing in this case, we can´t determinate the sex of this individual, so we conclude that the context 484 has an **INDETERMINATED SEX**.

- AGE DETERMINATION:

Method of the epiphyseal closure (MCKERN, STEWARD; 1957): Since the only preserved epiphysis in this individual are the ones located in the scapula (scapular acromion and scapular medial border), and since both of them are fused around 23 years old, this method allow us to determine than the individual had, as minimal, this age. So we seem to be facing, an ADULT INDIVIDUAL.

Method of the cranial suture closure (MEINDL, LOVEJOY; 1985): Not applicable (skull is missing).

Method of the dental eruption development (UBELAKER; 1989): Not applicable (dentition is missing).

Method of the dental wear analysis (BROTHWELL; 1981): Not applicable (dentition is missing).

Method of the pubic simphyseal surface (SUCHEY, BROOKS; 1990): Not applicable (pelvic griddle is missing).

Method of the auricular surface of the ilium (LOVEJOY *et al.*; 1985): Not applicable (pelvic griddle is missing).

We can conclude than the age rate of the context 484 individual of Ille Cave corresponds to an **ADULT** individual, but we can´t be more precise about the age.

BIOLOGICAL PROFILE I (SEX AND AGE).	CONTEXT Nº: 703

- SEX DETERMINATION:

Method of the cranial and pelvis morphologies (BUIKSTRA, UBELAKER; 1994):

Since both the skull and the pelvic griddle are missing in this case, we can´t determinate the sex of this individual, so we conclude that the context 703 has an **INDETERMINATED SEX**.

- AGE DETERMINATION:

Method of the epiphyseal closure (MCKERN, STEWARD; 1957): Not applicable (all the epiphysis used in this method are missing).

Method of the cranial suture closure (MEINDL, LOVEJOY; 1985): Not applicable (skull is missing).

Method of the dental eruption development (UBELAKER; 1989): Not applicable (dentition is missing).

Method of the dental wear analysis (BROTHWELL; 1981): Not applicable (dentition is missing).

Method of the pubic simphyseal surface (SUCHEY, BROOKS; 1990): Not applicable (pelvic griddle is missing).

Method of the auricular surface of the ilium (LOVEJOY *et al.*; 1985): Not applicable (pelvic griddle is missing).

We can´t conclude the age rate for the context 703 individual of Ille Cave with any of the methods used in this study, so we will record it as a case of **INDETERMINATED AGE**.

BIOLOGICAL PROFILE I (SEX AND AGE).	CONTEXT Nº: 727

- SEX DETERMINATION:

Method of the cranial and pelvis morphologies (BUIKSTRA, UBELAKER; 1994):

CRANIAL FEATURES	FEMININE	MASCULINE
Profile of the supraorbital ridge/glabella	(Not determinable)	
Inclination of the frontal bone	(Not determinable)	
Prognatism	(Not determinable)	
Frontal eminences (bosses)	(Not determinable)	
Temporal eminences (bosses)	(Not determinable)	
Superciliary arches	**X**	
Orbital outline (shape)	(Not determinable)	
Supraorbital margin (section)	**X**	
Zygomatic bone	(Not determinable)	
Mastoid process		**X**
Suprameatal/supramastoid crest	**X**	
External occipital protuberance	(Not determinable)	
Occipital condyles	(Not determinable)	
Palate	**X**	
Nuchal crest	Not determinable)	
Mental eminence	**X**	
Inferior edge of the mandible	**X**	
Gonial angle of the mandible	**X**	
Ascending ramus (mandible)	**X**	

PELVIC GRIDLE FEATURES	FEMININE	MASCULINE
General morphology	(Not determinable)	
Interior of the pelvis (“birth canal”)	(Not determinable)	
Subpubic angle	(Not determinable)	
Iliac crest (superior edge)	(Not determinable)	
Acetabulum (femur articulation)		**X**
Greater sciatic notch	**X**	
Auricular surface	**X**	
Compound arch	(Not determinable)	
Preauricular sulcus	**X**	
Pubic symphysis	(Not determinable)	
Ventral arch	(Not determinable)	
Subpubic concavity	(Not determinable)	
Ischiopubic ramus (medial)	(Not determinable)	
Obturator foramen	(Not determinable)	
Ischial tuberosity	(Not determinable)	
Ischial spine	(Not determinable)	
Alae (sacrum)	(Not determinable)	
Concave anterior sacral surface	(Not determinable)	
Auricular surface of the sacrum (sacroiliac joint)	(Not determinable)	

The pelvic features don´t offer a clear result, since they seem contradictory and the analysis of almost them all is not possible (fragmented, not present parts, etc), but is interesting the presence of the preauricular sulcus, quite a feminine feature. Since the cranial skeleton offers us a wider variety of features to analyze, and (with just an exception) they use to point to feminine dimorphic morphologies, we can consider the context 727 individual as a **PROBABLE FEMALE INDIVIDUAL**.

- AGE DETERMINATION:

Method of the epiphyseal closure (MCKERN, STEWARD; 1957): Since the sternal epiphysis of the clavicles are not conserved (last epiphysis to get fused in the human skeleton), the higher age rate which we can determine for the context 727 corresponds to a minimal of 22-23 years (so a YOUNG ADULT), since the epiphysis which fuse before (scapular acromion, humeral proximal end, distal ulna) are completely closed around this age.

Method of the cranial suture closure (MEINDL, LOVEJOY; 1985): Not applicable (fragmented skull).

Method of the dental eruption development (UBELAKER; 1989): Since the third molar is already erupted, we can assume more than 21 years for the individual, which makes it to be a YOUNG ADULT.

Method of the dental wear analysis (BROTHWELL; 1981): In the maxillary the three molars are quite worn, affected mainly in the inner part of the crown, in which the enamel is missing (maintained the periferical enamel). This should correspond to an age ratio of 25-35 years old (YOUNG ADULT?), but in the mandible all the molars are much more worn, losing completely the enamel, especially in the case of the third molar (which would surround the age to an older individual). Possibly this is because of dietary reasons, so in this case the method is not too much dependable.

Method of the pubic simphyseal surface (SUCHEY, BROOKS; 1990): Not applicable (just preserved a fragment of the right side pubic symphysis, which doesn´t give enough information).

Method of the auricular surface of the ilium (LOVEJOY *et al.*; 1985): Is just preserved the auricular surface of the right ilium, but the conservation status seems quite good. Since the porosity of the surface is already lost (seems quite flat beside the concretions) and there is no presence of deterioration process associated to the elderly (porosity, lipping, etc), we can determine than the individual would be in the phases 5 or 6 proposed by Lovejoy *et al.*, but we can´t determine the level of densification of the surface clearly cause the taphonomical problematic. That's why this method results in an age of 40-49 years old, which corresponds to a MIDDLE ADULT.

We can conclude than the age rate of the context 727 individual of Ille Cave corresponds to a **MIDDLE ADULT** individual (of 40-49 years old).

BIOLOGICAL PROFILE I (SEX AND AGE).	CONTEXT Nº: 755

- SEX DETERMINATION:

Method of the cranial and pelvis morphologies (BUIKSTRA, UBELAKER; 1994):

CRANIAL FEATURES	FEMININE	MASCULINE
Profile of the supraorbital ridge/glabella		**X**
Inclination of the frontal bone		**X**
Prognatism	(Not determinable)	
Frontal eminences (bosses)		**X**
Temporal eminences (bosses)	(Not determinable)	
Superciliary arches	**X**	
Orbital outline (shape)		**X**
Supraorbital margin (section)		**X**
Zygomatic bone	**X**	
Mastoid process		**X**
Suprameatal/supramastoid crest		**X**
External occipital protuberance	**X**	
Occipital condyles		**X**
Palate	(Not determinable)	
Nuchal crest	**X**	
Mental eminence		**X**
Inferior edge of the mandible		**X**
Gonial angle of the mandible	**X**	
Ascending ramus (mandible)	**X**	

The pelvic griddle is not preserved in this individual, so we just could approach to part of the features from the skull. There, we could observe a dominant presence of male features, but some other pointed to more feminine characteristics (10 male features, 6 female features, 3 not determinable). As we will show in a while, the age of the individual seems quite young, so the physiological changes that human body suffers in the adolescence possibly where still developing in his organism. So, we could determine that we are facing a **PROBABLE MALE INDIVIDUAL**.

- AGE DETERMINATION:

Method of the epiphyseal closure (MCKERN, STEWARD; 1957): Neither one of the epiphysis analyzed in this method are preserved, so we can´t use it.

Method of the cranial suture closure (MEINDL, LOVEJOY; 1985): Not applicable (almost all the cranial sutures are missing).

Method of the dental eruption development (UBELAKER; 1989): Since the third molar is already erupted, we can assume more than 21 years for the individual, which makes it to be, at least, a YOUNG ADULT.

Method of the dental wear analysis (BROTHWELL; 1981): In this case, we can observe clearly all the mandibular molars, which offer a similar wear pattern in both sides: since the first molars are starting to supper the exposition of the dentine, M2 and M3 just show some superficial wear of the cones. This could point to an age of 17-25 years old (YOUNG ADULT, or even SUB-ADULT).

Method of the pubic simphyseal surface (SUCHEY, BROOKS; 1990): The pubic symphysis is not preserved, so this method is not useful in this particular case.

Method of the auricular surface of the ilium (LOVEJOY *et al.*; 1985): The ilium is not preserved, so we can´t approach trough this method.

We can conclude than the age rate of the context 755 individual of Ille Cave probably corresponds to a **YOUNG ADULT** individual of around 21-25 years old, according to the only two methods which we could use (dental eruption and teeth wear), which in this case are quite accurate if we attend to the good conservation status of the mandibular dental pieces.

BIOLOGICAL PROFILE I (SEX AND AGE).	CONTEXT Nº: 800

- SEX DETERMINATION:

Method of the cranial and pelvis morphologies (BUIKSTRA, UBELAKER; 1994):

CRANIAL FEATURES	FEMININE	MASCULINE
Profile of the supraorbital ridge/glabella	**X**	
Inclination of the frontal bone	**X**	
Prognatism	(Not determinable)	
Frontal eminences (bosses)	(Not determinable)	
Temporal eminences (bosses)	(Not determinable)	
Superciliary arches	**X**	
Orbital outline (shape)	(Not determinable)	
Supraorbital margin (section)	**X**	
Zygomatic bone	(Not determinable)	
Mastoid process	(Not determinable)	
Suprameatal/supramastoid crest	(Not determinable)	
External occipital protuberance	(Not determinable)	
Occipital condyles	(Not determinable)	
Palate	(Not determinable)	
Nuchal crest	Not determinable)	
Mental eminence	(Not determinable)	
Inferior edge of the mandible		**X**
Gonial angle of the mandible	(Not determinable)	
Ascending ramus (mandible)	(Not determinable)	

Since the pelvis is not present in this individual and we could just analyze some features of the skull (4 feminine vrs. 1 masculine), we can determine that this individual is a **PROBABLY FEMALE** one.

- AGE DETERMINATION:

Method of the epiphyseal closure (MCKERN, STEWARD; 1957): Since the sternal epiphysis of the right clavicle (last epiphysis to get fused in the human skeleton) is conserved and fused, we can assume at least 30 year for this individual, so is an OLD YOUNG ADULT-MIDDLE ADULT.

Method of the cranial suture closure (MEINDL, LOVEJOY; 1985): Not applicable (disconnected and incomplete sutures).

Method of the dental eruption development (UBELAKER; 1989): Since the third molar is already erupted in both mandible and maxilla, we can determine at least 21 years for this individual, so it would be At least a YOUNG ADULT.

Method of the dental wear analysis (BROTHWELL; 1981): The crowns of M1 and M2 in both sides of the mandible are quite weared, especially in the case of M1, in

which the dentine is shown and the cavities which appeared where the crowns used to be are now connected (not so much in the case of M2, in which the cavities are still isolated). Instead, M3 surface just started to flat the enamel, while there are no signs of exposition of the dentine yet. According to Brothwell´s method, this would be equivalent to an age of 25-35 years old, so a YOUNG ADULT individual.

Method of the pubic simphyseal surface (SUCHEY, BROOKS; 1990): Not applicable (pelvic griddle is missing).

Method of the auricular surface of the ilium (LOVEJOY *et al.*; 1985): Not applicable (pelvic griddle is missing).

We can conclude than the age rate of the context 800 individual of Ille Cave corresponds to a **YOUNG ADULT** of, at least, 30 years old (so almost middle adult already, as the clavicle suture shows).

BIOLOGICAL PROFILE I (SEX AND AGE).	CONTEXT Nº: 907

- SEX DETERMINATION:

Method of the cranial and pelvis morphologies (BUIKSTRA, UBELAKER; 1994):

Since the pelvic griddle is missing (except of a fragment of the left sacro-iliac joint, which doesn´t offer any dimorphic landmark to analyze) and the only part of the skull represented is the fragmented maxilla and mandible (which offers some characteristics that could point to a male -gonial angle, thick ascending ramus and inferior edge-, but which we can´t consider enough for a clear sexual diagnosis), we can say that the individual from the context 907 of Ille Cave has an **INDETERMINATED SEX**.

- AGE DETERMINATION:

Method of the epiphyseal closure (MCKERN, STEWARD; 1957): Since almost all the skeleton is missing, is not possible to use this method.

Method of the cranial suture closure (MEINDL, LOVEJOY; 1985): Not applicable (no cranial sutures preserved).

Method of the dental eruption development (UBELAKER; 1989): Since the third molar is already erupted in both sides of the mandible, we can assume more than 21 years for the individual, which makes it to be a YOUNG ADULT.

Method of the dental wear analysis (BROTHWELL; 1981): The erosion of the third molars in both sides of the mandible is quite light, since just affects to the enamel in the buccal-labial side. The first molar of the right side and both the M2 are, instead, quite weared: the crowns seem almost flat, and the erosion is starting to show part of the dentine. This pattern is associated with an age of 25-35 years old in Brothwell´s study, so we can assume we´re facing a YOUNG ADULT individual.

Method of the pubic simphyseal surface (SUCHEY, BROOKS; 1990): The pubic symphysis is not preserved, so we can´t approach trough this methodology.

Method of the auricular surface of the ilium (LOVEJOY *et al.*; 1985): The conservation status of the sacro-iliac joint which is present is so bad than this method can´t be used.

We can conclude than the age rate of the context 907 individual of Ille Cave probably corresponds to a **POSSIBLE YOUNG-MIDDLE ADULT** individual of 25-35 years old according to Brothwell method, but we have to be sceptic about this results, since no other method was used and the context status is really deteriorated.

BIOLOGICAL PROFILE I (SEX AND AGE).	CONTEXT Nº: 1337

- SEX DETERMINATION:

Method of the cranial and pelvis morphologies (BUIKSTRA, UBELAKER; 1994):

CRANIAL FEATURES	FEMININE	MASCULINE
Profile of the supraorbital ridge/glabella	**X**	
Inclination of the frontal bone	(Not determinable)	
Prognatism	(Not determinable)	
Frontal eminences (bosses)	(Not determinable)	
Temporal eminences (bosses)	(Not determinable)	
Superciliary arches		**X**
Orbital outline (shape)		**X**
Supraorbital margin (section)		**X**
Zygomatic bone	(Not determinable)	
Mastoid process		**X**
Suprameatal/supramastoid crest	(Not determinable)	
External occipital protuberance	(Not determinable)	
Occipital condyles	(Not determinable)	
Palate	(Not determinable)	
Nuchal crest	(Not determinable)	
Mental eminence		**X**
Inferior edge of the mandible		**X**
Gonial angle of the mandible		**X**
Ascending ramus (mandible)	**X**	

The pelvic griddle is not preserved in this individual, and we could just approach to a couple of features of the cranium. Since almost all these features analyzed pointed to male characteristics, we determine that we are facing a **PROBABLE MALE INDIVIDUAL**.

- AGE DETERMINATION:

Method of the epiphyseal closure (MCKERN, STEWARD; 1957): Neither one of the epiphysis analyzed in this method are preserved, so we can´t use it.

Method of the cranial suture closure (MEINDL, LOVEJOY; 1985): Not applicable (almost all the cranial sutures are missing).

Method of the dental eruption development (UBELAKER; 1989): Since the third molar is already erupted, we can assume more than 21 years for the individual, which makes it to be, at least, a YOUNG ADULT.

Method of the dental wear analysis (BROTHWELL; 1981): In this case, we can observe clearly all the mandibular molars, that the first molars present and advanced level of exposition of the dentine, while M2 and M3 don´t show as much dentine as M1,

with the crowns still visible. This could point to an age of 35-45 years old (MIDDLE ADULT, or even SUB-ADULT).

Method of the pubic simphyseal surface (SUCHEY, BROOKS; 1990): The pubic symphysis is not preserved, so this method is not useful in this particular case.

Method of the auricular surface of the ilium (LOVEJOY *et al.*; 1985): The ilium is not preserved, so we can´t approach trough this method.

We can conclude than the age rate of the context 1337 individual of Ille Cave probably corresponds to a **MIDDLE ADULT** individual of around 35-45 years old.

BIOLOGICAL PROFILE I (SEX AND AGE).	CONTEXT Nº: 1825

- SEX DETERMINATION:

Method of the cranial and pelvis morphologies (BUIKSTRA, UBELAKER; 1994):

CRANIAL FEATURES	FEMININE	MASCULINE
Profile of the supraorbital ridge/glabella	**X**	
Inclination of the frontal bone	(Not determinable)	
Prognatism	(Not determinable)	
Frontal eminences (bosses)	(Not determinable)	
Temporal eminences (bosses)	(Not determinable)	
Superciliary arches	(Not determinable)	
Orbital outline (shape)	(Not determinable)	
Supraorbital margin (section)		**X**
Zygomatic bone	(Not determinable)	
Mastoid process	(Not determinable)	
Suprameatal/supramastoid crest	(Not determinable)	
External occipital protuberance	(Not determinable)	
Occipital condyles	(Not determinable)	
Palate	(Not determinable)	
Nuchal crest	Not determinable)	
Mental eminence	(Not determinable)	
Inferior edge of the mandible	(Not determinable)	
Gonial angle of the mandible	(Not determinable)	
Ascending ramus (mandible)	(Not determinable)	

PELVIC GRIDLE FEATURES	FEMININE	MASCULINE
General morphology	(Not determinable)	
Interior of the pelvis (“birth canal”)	(Not determinable)	
Subpubic angle	(Not determinable)	
Iliac crest (superior edge)	(Not determinable)	
Acetabulum (femur articulation)	(Not determinable)	
Greater sciatic notch	(Not determinable)	
Auricular surface	(Not determinable)	
Compound arch	(Not determinable)	
Preauricular sulcus	(Not determinable)	
Pubic symphysis	(Not determinable)	
Ventral arch	(Not determinable)	
Subpubic concavity	(Not determinable)	
Ischiopubic ramus (medial)	(Not determinable)	
Obturator foramen	(Not determinable)	
Ischial tuberosity	(Not determinable)	
Ischial spine	(Not determinable)	
Alae (sacrum)	(Not determinable)	
Concave anterior sacral surface	(Not determinable)	
Auricular surface of the sacrum (sacroiliac joint)	(Not determinable)	

Since the pelvis is not preserved and the skull is so fragmented than just two of the features could be observed (offering, by the way, contradictory results), we can´t determine the sex of the individual in the context 1825, so **INDETERMINATE SEX**.

- AGE DETERMINATION:

Method of the epiphyseal closure (MCKERN, STEWARD; 1957): Not applicable (fragmented bones, all the epiphysis are missing).

Method of the cranial suture closure (MEINDL, LOVEJOY; 1985): Not applicable (fragmented skull).

Method of the dental eruption development (UBELAKER; 1989): Since the third molar is already erupted, we can assume more than 21 years for the individual, which makes it to be a YOUNG ADULT.

Method of the dental wear analysis (BROTHWELL; 1981): In the right mandible side (the only part of the mouth which preserves all the molars), M1 seems more wear than M2 and M3, but we still can identify the cusps in all of them. The wear level is still quite light, corresponding to the phase of 25-35 years old suggested by the method. So is possibly a YOUNG ADULT.

Method of the pubic simphyseal surface (SUCHEY, BROOKS; 1990): Not applicable (not pelvis preserved).

Method of the auricular surface of the ilium (LOVEJOY *et al.*; 1985): Not applicable (not pelvis preserved).

We can conclude than the age rate of the context 1825 individual of Ille Cave corresponds to a **YOUNG ADULT** individual (of 25-35 years old).

BIOLOGICAL PROFILE I (SEX AND AGE).	CONTEXT Nº: 2240

- SEX DETERMINATION:

Method of the cranial and pelvis morphologies (BUIKSTRA, UBELAKER; 1994):

Since the skull and almost all the pelvic griddle are missing in this case, we can´t determinate the sex of this individual, so we conclude that the context 2240 has an **INDETERMINATED SEX**.

- AGE DETERMINATION:

Method of the epiphyseal closure (MCKERN, STEWARD; 1957): Since the only preserved epiphysis are the scapular acromion (closes at 23 years old) and the ones from the arm bones (humeral medial epicondyle and distal radius, which closes at 20; proximal radius and ulna, which are closed by 19; and distal ulna, which closes at 24-25 years), we can assume a minimal age of 24-25 years for this individual, so it would be at least a YOUNG ADULT.

Method of the cranial suture closure (MEINDL, LOVEJOY; 1985): Not applicable (skull is missing).

Method of the dental eruption development (UBELAKER; 1989): Not applicable (dentition is missing).

Method of the dental wear analysis (BROTHWELL; 1981): Not applicable (dentition is missing).

Method of the pubic simphyseal surface (SUCHEY, BROOKS; 1990): Not applicable (pelvic griddle is missing).

Method of the auricular surface of the ilium (LOVEJOY *et al.*; 1985): Not applicable (pelvic griddle is missing).

We can conclude than the age rate of the context 2240 individual of Ille Cave corresponds to an **ADULT** individual, but we can´t be more precise about the age.

BIOLOGICAL PROFILE I (SEX AND AGE).	CONTEXT Nº: 2247

- SEX DETERMINATION:

Method of the cranial and pelvis morphologies (BUIKSTRA, UBELAKER; 1994):

CRANIAL FEATURES	FEMININE	MASCULINE
Profile of the supraorbital ridge/glabella		**X**
Inclination of the frontal bone		**X**
Prognatism		**X**
Frontal eminences (bosses)		**X**
Temporal eminences (bosses)	(Not determinable)	
Superciliary arches		**X**
Orbital outline (shape)		**X**
Supraorbital margin (section)		**X**
Zygomatic bone	(Not determinable)	
Mastoid process	(Not determinable)	
Suprameatal/supramastoid crest	(Not determinable)	
External occipital protuberance	(Not determinable)	
Occipital condyles	(Not determinable)	
Palate		**X**
Nuchal crest	(Not determinable)	
Mental eminence		**X**
Inferior edge of the mandible		**X**
Gonial angle of the mandible		**X**
Ascending ramus (mandible)		**X**

PELVIC GRIDLE FEATURES	FEMININE	MASCULINE
General morphology	(Not determinable)	
Interior of the pelvis (“birth canal”)	(Not determinable)	
Subpubic angle		**X**
Iliac crest (superior edge)		**X**
Acetabulum (femur articulation)		**X**
Greater sciatic notch		**X**
Auricular surface		**X**
Compound arch		**X**
Preauricular sulcus		**X**
Pubic symphysis	**X**	
Ventral arch		**X**
Subpubic concavity		**X**
Ischiopubic ramus (medial)	(Not determinable)	
Obturator foramen		**X**
Ischial tuberosity	(Not determinable)	
Ischial spine		**X**
Alae (sacrum)		**X**
Concave anterior sacral surface	(Not determinable)	
Auricular surface of the sacrum (sacroiliac joint)		**X**

Since all the features analyzed both in the skull and in the pelvic griddle point clearly to male features, except of one (the size of the pubic symphysis seems quite gracile, but

the bone is really degenerated around it, so maybe its due to the conservation status itself), we can consider the context 2247 individual as a clearly **MALE INDIVIDUAL**.

- AGE DETERMINATION:

Method of the epiphyseal closure (MCKERN, STEWARD; 1957): Since the sternal epiphysis of the clavicles are not conserved (last epiphysis to get fused in the human skeleton), the higher age rate which we can determine for the context 2247 corresponds to a minimal of 24-25 years (so a YOUNG ADULT), since the epiphysis which fuse before (distal ulna and iliac crest) are completely closed around this age.

Method of the cranial suture closure (MEINDL, LOVEJOY; 1985): Not applicable (almost all the cranial sutures are missing).

Method of the dental eruption development (UBELAKER; 1989): Since the third molar is already erupted, we can assume more than 21 years for the individual, which makes it to be a YOUNG ADULT.

Method of the dental wear analysis (BROTHWELL; 1981): In this case, we can just observe clearly the molars in the right side of the mandible (the left side is covered by concretions, and the maxillary dentition is missing, with the exception of the first incisives). It could point to an age of 25-35 years old (YOUNG ADULT), but since the pieces are also partially covered with concretions, we can´t completely trust in this method for approaching this particular case.

Method of the pubic simphyseal surface (SUCHEY, BROOKS; 1990): The pubic symphysis of the right side (the only one preserved) doesn´t allow the analysis, since is affected by a possible pathology which deteriorated the bone structure, so this method is not useful in this particular case.

Method of the auricular surface of the ilium (LOVEJOY *et al.*; 1985): Is just preserved the auricular surface of the right ilium, but the conservation status seems quite good. We can observe that the porosity of the surface is starting to disappear, revealing some areas in which the surface seems now much denser. So, we can determine than the individual would be in the phase 5 proposed by Lovejoy *et al.*, which results in an age of 40-44 years old, which corresponds to a MIDDLE ADULT.

We can conclude than the age rate of the context 2247 individual of Ille Cave probably corresponds to a **YOUNG-MIDDLE ADULT** individual of 24-49 years old.

ANNEX III

REGISTER OF PALEOPATHOLOGIES FILES.

BIOLOGICAL PROFILE II (PALEOPATHOLOGIES).	CONTEXT Nº: 67

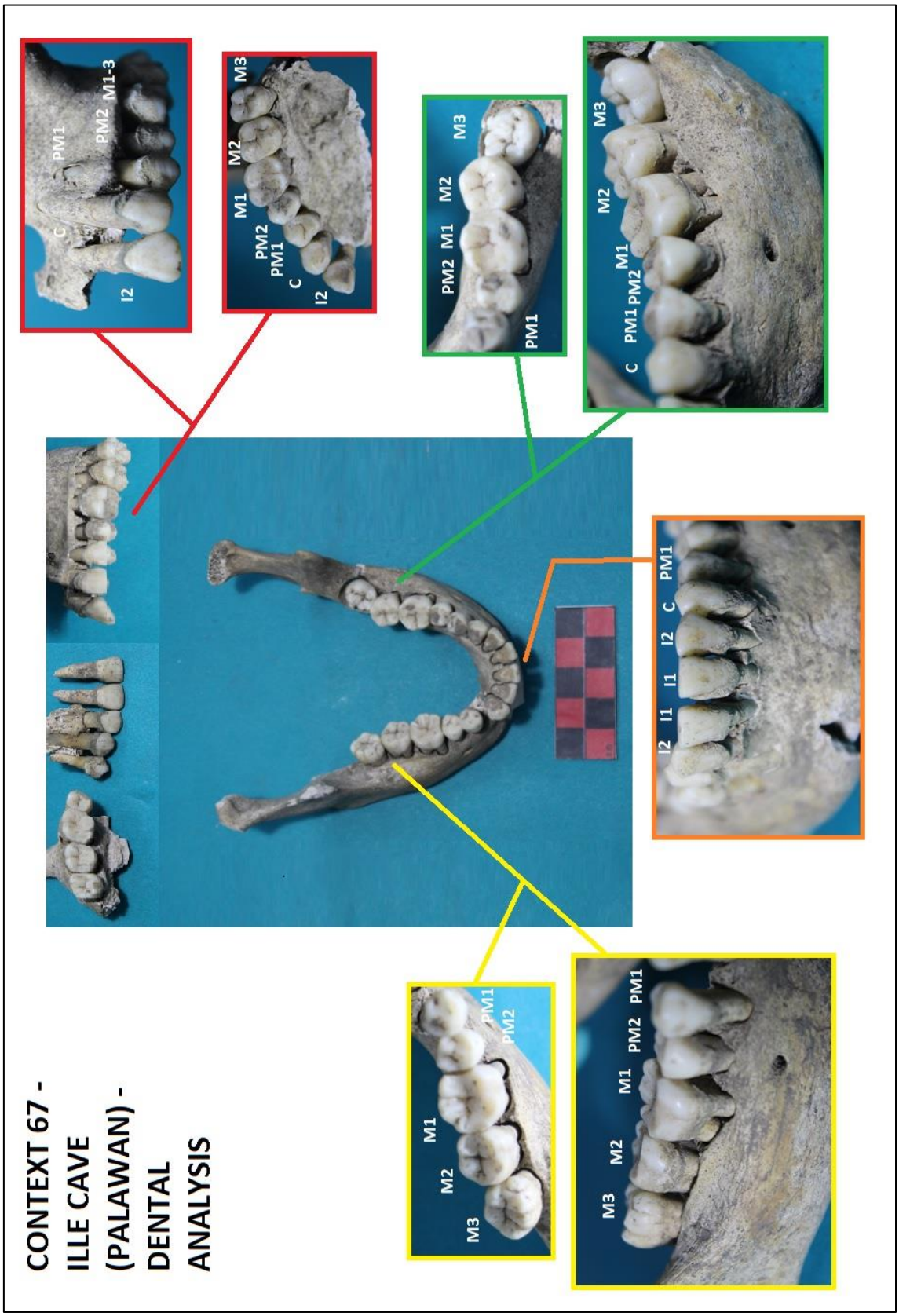
- DENTAL DISEASES.

About the **TEETH WEAR** of this individual, we could observe that the erosion of the dental pieces affected lightly just some surfaces, always occlusal, which could be a consequence of the natural **ATRITION**. Anyway the individual was still a young one (just passed from subadult to adult), so it´s not strange that the dental pieces are almost intact yet. We couldn´t see any other pattern of wear which pointed to any particular activity or to any abrasive component in the diet.

We could also determine a case of **TEETH ROOT EXPOSURE** which was evident in both maxillary and mandibular sides, as well as the presence of **REACTIVE BONE IN THE ALVEOLAR SURFACES**, which could point to a possible infectious disease, for example a possible case of periodontal disease. The presence of several deposits of mineralized plaque over the surface of the teeth (**CALCULUS**) in almost all the pieces could also point to the presence of an infectious disease. The calculus deposits appeared in labial-buccal aspect in all the pieces of both maxilla and mandible (except the mandibular LM3, since was not still completely erupted), and also in the lingual aspect of the premolars and molars.

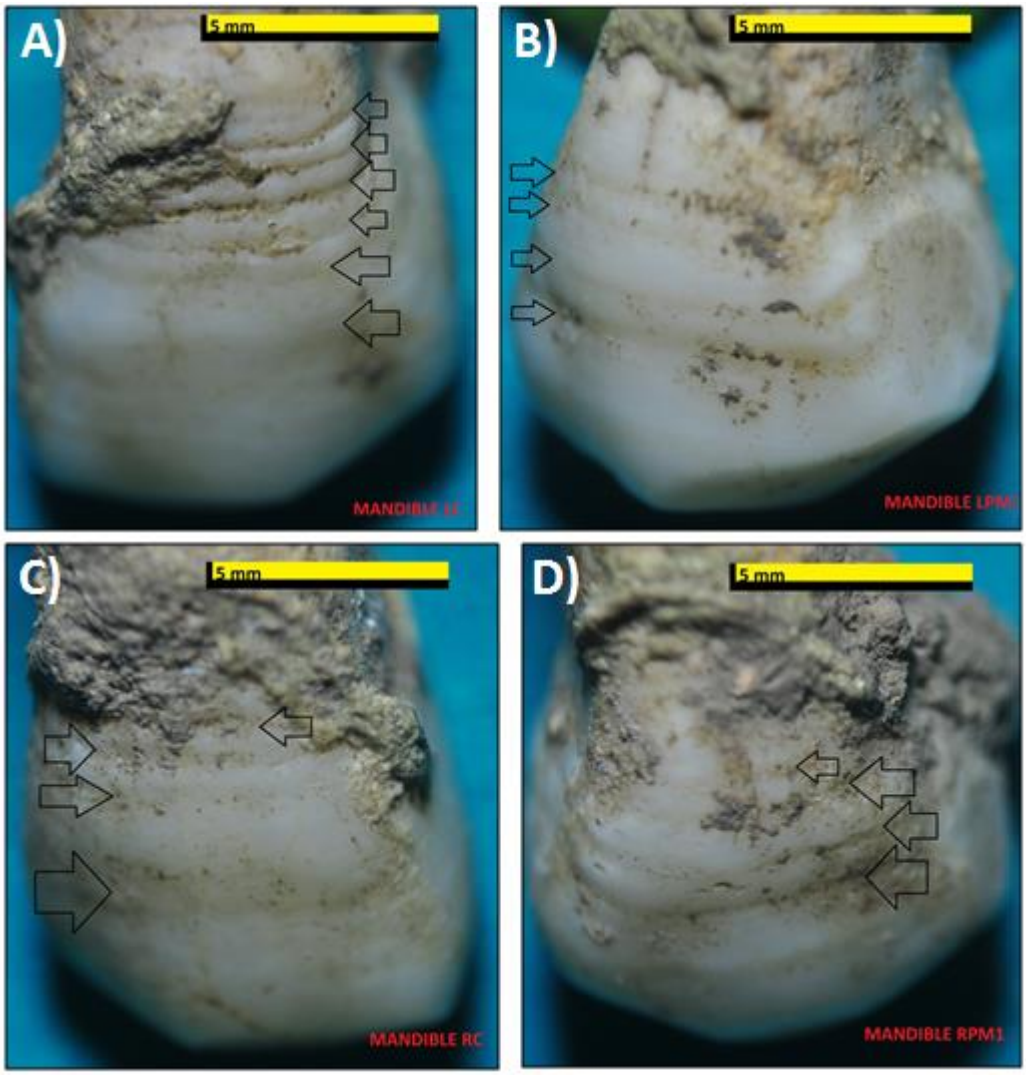
Also, an **ENAMEL PEARL** was noticed in the buccal-lingual aspect of the left maxillary M3. The enamel accumulation appears in the edge of the teeth, just in the upper limit of the tooth root

A): Lateral and inferior views of the mandibular LM3, in which we can appreciate that the root is not still completely developed. B): Detail of the buccal-lingual surface of maxillary M3, in which we can observe the enamel pearl registered.

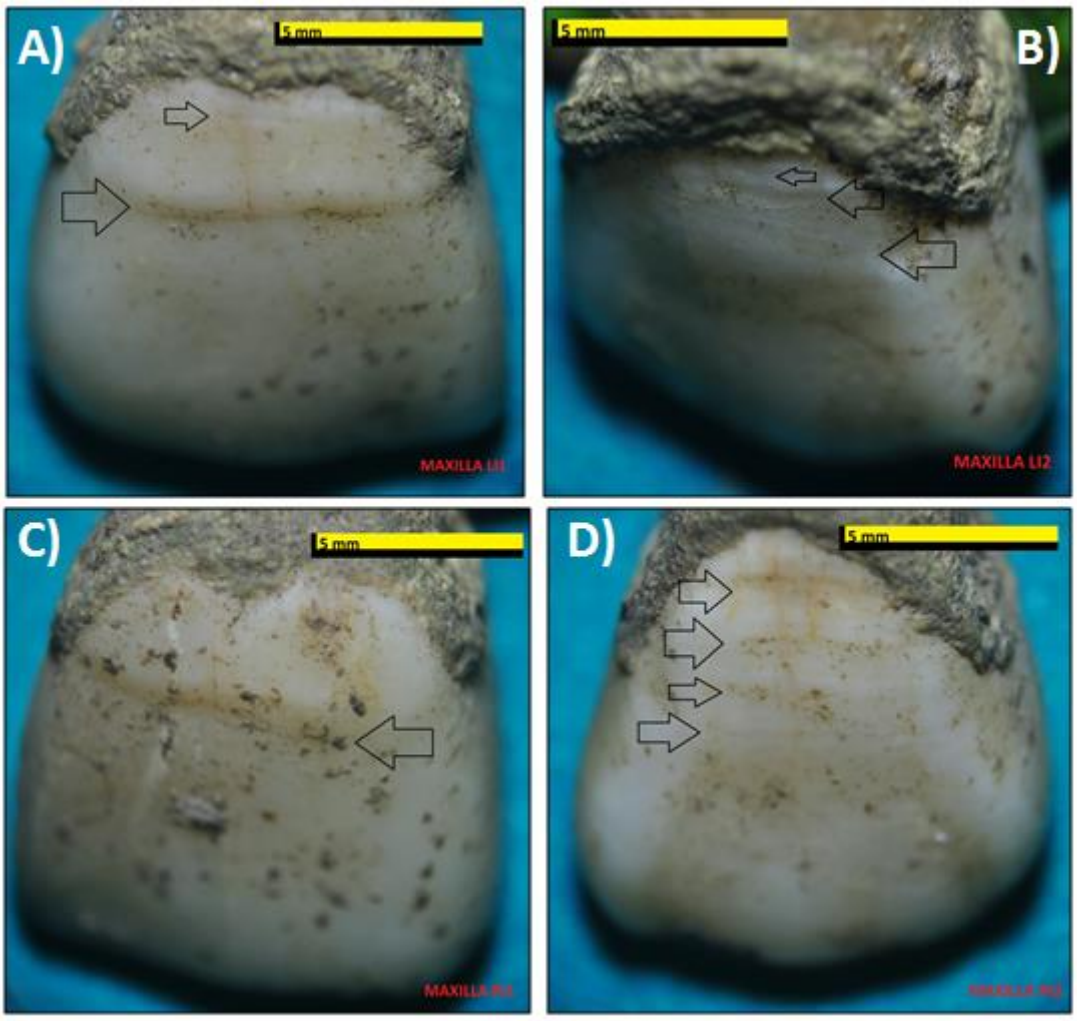


Dentition of the context 67. We can observe the labial-buccal accumulation of calculus in the different teeth, the wear patterns, the root exposure and the signs of infection in the alveolar bone in both mandible and maxilla.

Finally, it has also been registered the presence of a case of **DENTAL ENAMEL HYPOPLASIA**, characterized by the typical transverse lines and grooves on the surface of tooth crowns, clearly visible in this case in the four upper maxillary incisors (LI1, LI2, RI1, RI2) and in the mandibular canines and first premolars (LC, RC, LPM1, RPM1). Even if the macroscopical analysis already allowed us to determine its presence in these dental pieces (the grooves where easy to distinguish), a microscopical analysis was made over the 8 dental pieces, with positive results in all the cases (as we display in the following pictures).



Results of the microscopical analysis made over several mandibular dental pieces of the skeleton in the context 67, in which we can appreciate the typical transverse lines of DEH. From A) to D): mandibular LC, LPM1, RC and RPM1. Notice that the teeth are not displayed in anatomical position (their roots are pointing up), but upside down, cause of photographical reasons (the microscope light worked better in this position, helping to illuminate the grooves and making easier the register of the pathology).



Microscope images of the analyzed maxillary teeth of the context 67, in which again the marked transverse lines determine the presence of DEH. From A) to D): maxillary LI1, LI2, RI1 and RI2.

BIOLOGICAL PROFILE II (PALEOPATHOLOGIES).	CONTEXT Nº: 484

- TRAUMA.

This individual presented evidence of paleopathological conditions in the costovertebral area, in the right side of the thorax (the ribs of the left side are missing):

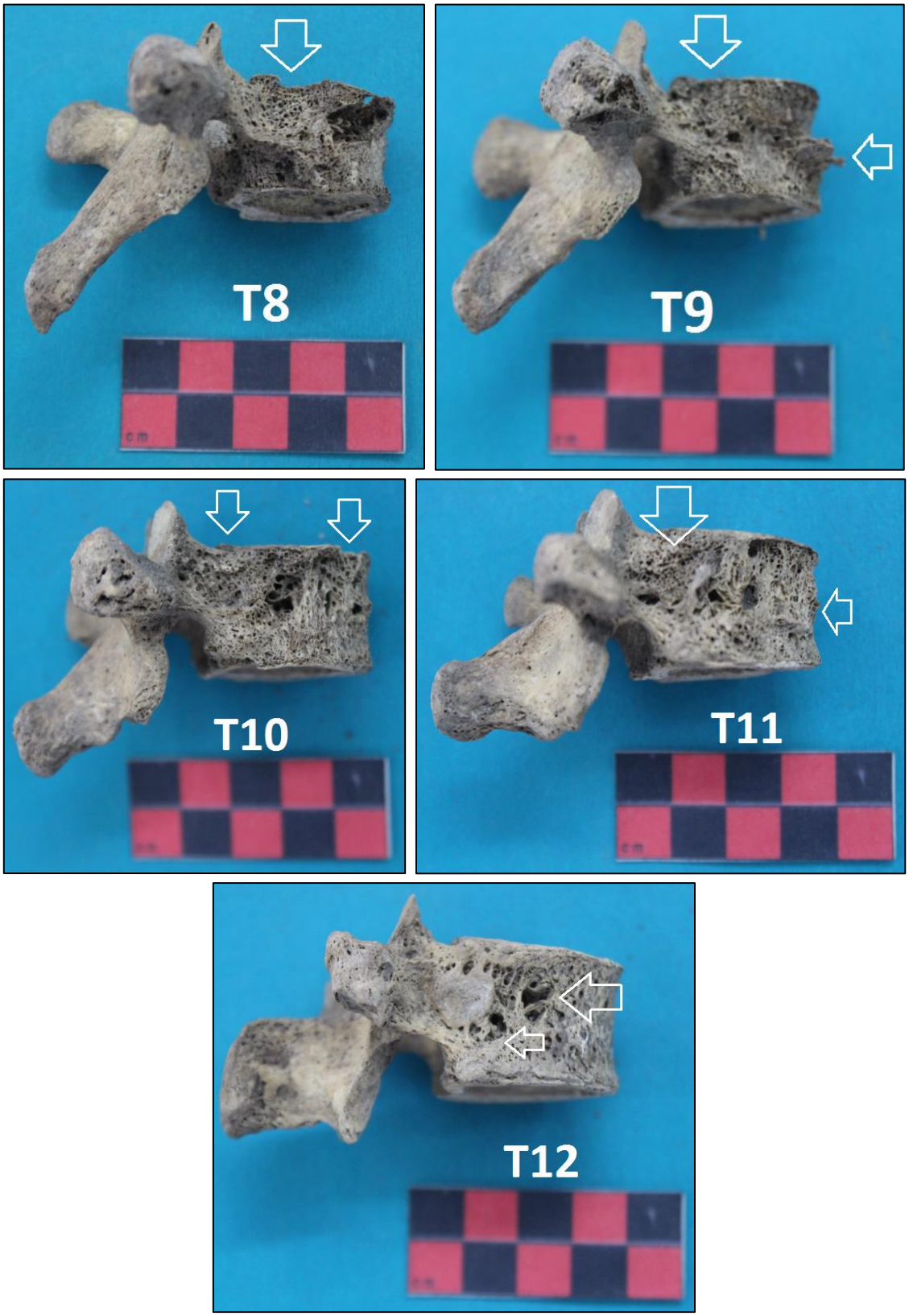
- Vertebrae: all the thoracic and lumbar vertebrae preserved, from T8 to L1, presented signs of possible infection, especially profuse in the right side, around the area of insertion of the corresponding ribs. The area appeared covered with porosity and reactive bone, plus some thin osteophytes which were projected out of the vertebral bodies (possible ossification of the radiated ligaments, which hold the articulations of each rib with the corresponding vertebra).

- Ribs: all the ribs preserved, from the 2nd rib and till the 11th one, presented an irregular shape on their heads, around the articulation process with the vertebral column. In all the cases new bone growth around the heads, which deformed the original shape of the cortical surfaces. This new tissue growth in interior direction, extending the bone head and the beginning of the rib bodies inside the thoracic cage, creating flat-shaped surfaces. In some other cases (5th, 6th, 9th, 10th ribs), the surface of the new bone presented negative semicircular marks, which could point to the overlap of another structure which made impossible the growth of the bone in this direction, being a limitation for it. Finally, in the case of the 6th rib, an osteophyte developed from the interior side of the head directed to the inner thorax, in a vertical sense, giving it the aspect of a vertical bonny spike.

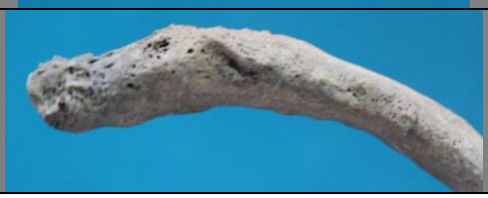
X-Ray analysis was done over all the ribs, both in superior and inferior views, in order to detect possible conditions which where not identifiable macroscopically (for example, lines of healed fractures). Although the results didn´t show any hidden marker which was not registered during the laboratorial analysis, confirmed and helped the understanding of the growth dynamics of the bone remodeling in the rib heads, confirming again their direction (pointed to the interior of the thoracic cage).

Some pathological conditions which presented similar markers where selected for the differential diagnosis, being all of them discarded because of different reasons:

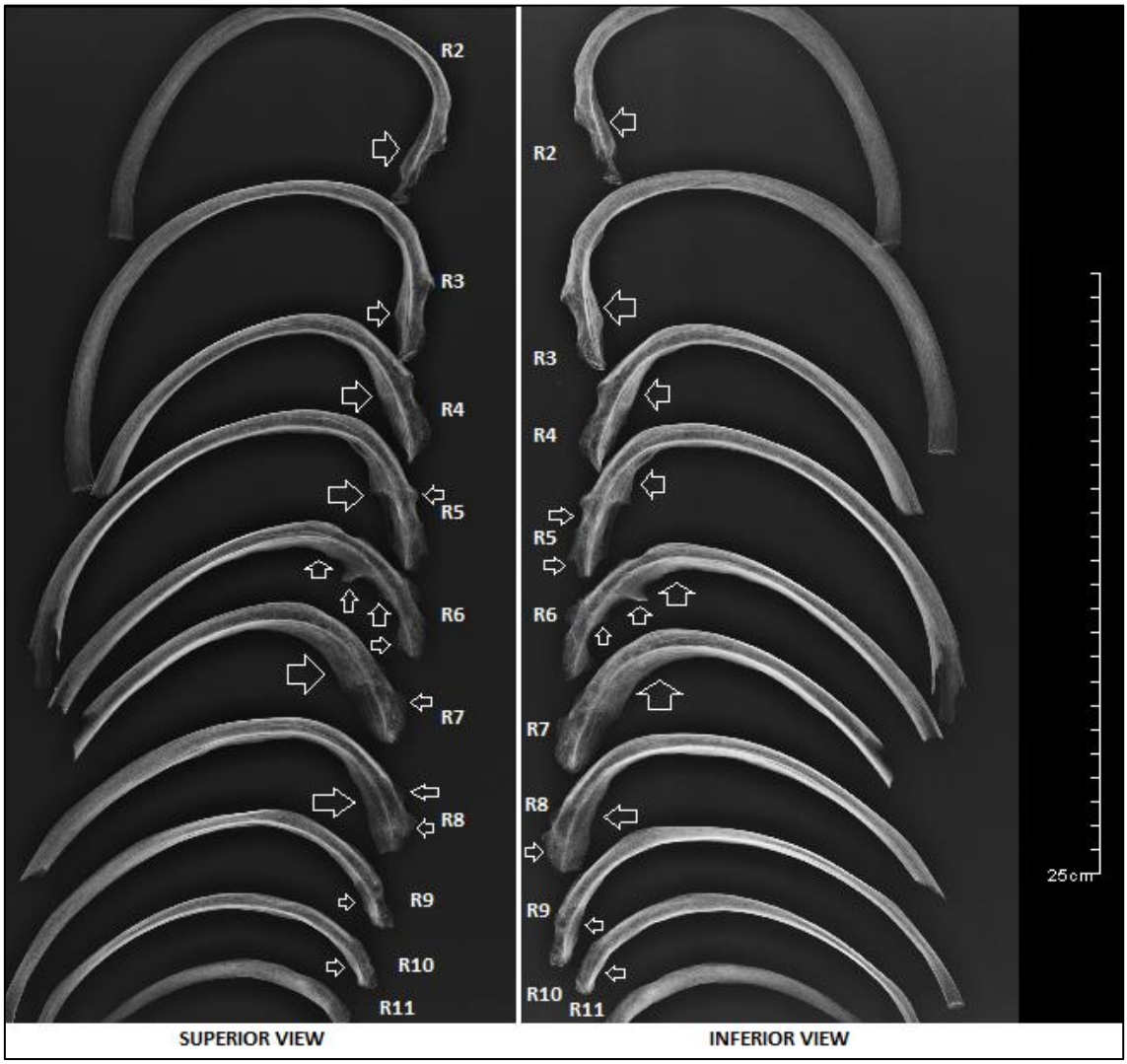
- Costovertebral joint osteoarthritis: the arthropaties present signs of contact between bone surfaces, which cause the growth of new bone tissue, but in this case no signs of this contact was observed (such as the eburnation of any surface), and the new bone growth in a too regular pattern which suggested that other anatomical structures could have guided it.



Some of the pathological markers registered in the articulation process of the right side of several vertebrae, in the column of the individual from context 484. Notice the porosity, the reactive bone and some osteophytes (pointed with white arrows).

RIB Nº.	RIB HEAD – EXTERNAL VIEW	RIB HEAD – INTERIOR VIEW
3rd		
4th		
5th		
6th		
7th		
8th		
9th		

External and internal view of the heads of the ribs from 3rd to 9th of the individual from context 484 of Ille Cave. The altered morphology, as a result of the process of bone remodeling, can be observed in every case, in the shape of flat projections, concavities (5th, 9th) and osteophytes (6th , for example).



X-Ray results for the right side ribs of the individual from context 484 of Ille Cave. Several cases of bone remodeling can be observed in every rib head (white arrows), altering the original morphology of the bone.

- Ankylosing spondylitis: discarded because there was no presence of morphological changes in the intervertebral surfaces (inflamated tissues, Andersson´s lesions) nor simetric syndesmophytes (calcified soft tissues, such as ligaments). Also not present the tipical intervertebral fusion of the advances stages of this condition.
- Brucellar spondylitis: althought this kind of spondylitis doesn´t imply the destruction of the intervertebral discs, the signs previously descripted for the ankylosing variety where not present, what allowed to discard it.
- Tuberculosis with spinal and rib involvement: discarted, since no signs of vertebral colapse, paravertebral abscess or tubercular abscess.

For understanding better the process of the bone growth, the ribs where reassembled attending to the possible connection between the flat surfaces and the few concavities and circular-shaped negatives. Was noticed that the head of the 8th rib fixed in the original articulation process of T8, but the growth of new bone in the rib head had

eroded partially the vertebral body. Even in this status the connection was still possible. Since all the superior vertebrae where missing, the reassemblage of the superior ribs was done attending to their surfaces and some signs of contact beneath them. The result showed a compression and overlap of all the ribs from 2nd to 7th over the 8th rib, wich possibly remained *in situ*, as we can see in the inferior images. The inferior ribs possibly where also disconected, since the new bone formation completely disfigured the articulation process of their corresponding vertebrae.

Proposal of reassembly of vertebrae and ribs of the individual from context 484, which displays the original position of the ribs during the bone alterations suffered after the trauma.

This interpretation pointed to a probable case of **COSTOVERTEBRAL TRAUMA**, wich implied the dislocation of the ribs of the right side of the thorax, and which started a healing process without being reinserted in their original position. Since the rest of the thorax is not preserved, but the scapula from the same side doesn´t present any sign of pathological condition (what could point to a vertical direction of the strenght wich caused the trauma), we point to a possible blunt force injury from the back, wich

dislocated the ribs (some examples of possible causes would be: falling back from a considerable height, or over a hard surface, the impact of a heavy object falling over the back of the individual, etc).

The individual survived, at least, enough time for the ossification process to start: even if the ribs where not fused, the bone reacted creating new cortical surfaces, wich adapted their shape to the spaces left between the contiguous ribs and other organs. Possibly, the infectious signs observed over the vertebrae, and wich are especially visible in the right side (same side in wich the trauma is present), are a direct consequence of the trauma.

BIOLOGICAL PROFILE II (PALEOPATHOLOGIES).	CONTEXT Nº: 703

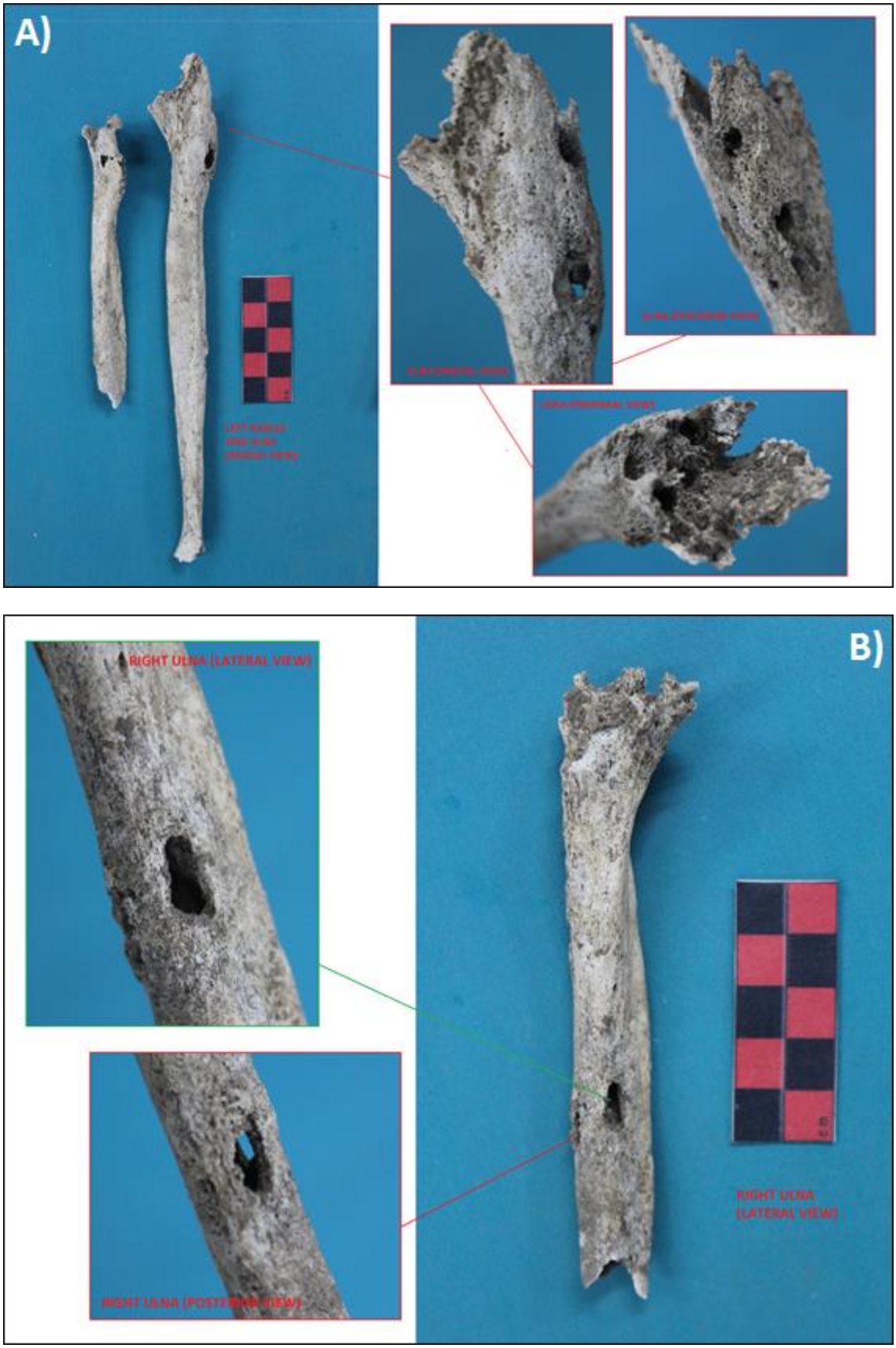
- INFECTIOUS DISEASES.

The only pathology which we could determine in the case of this individual was an infectious disease which affected absolutely all the surfaces of all the present bones (both tibia and both fibulae in the legs, and both ulna and the left radius of the forearms). All the bone surfaces presented a really irregular texture (with a wooden texture in some parts, or covered by reactive bone in others, as well as with a recurrent porosity), and also some shape irregularities (the big size of the neck in the proximal epiphysis of the left ulna, the big section of the neck of the right tibia –which we could compare to a much more natural size in the left side- and its bulging aspect, and also the irregularities in the cylindrical shape of both the tibial diaphysis) affected the bone structures. Also, all the bones where covered with lot of different openings (all of them with oval or circular shapes) which go through the bone cortex.

This aspects could point to a case of **SUPPURATIVE/PYOGENIC OSTEOMYELITIS**, an illness which normally affects (like in this case) the long bones and which is easy to distinguish from other infectious diseases because of the presence of two distinctive markers: the INVOLUCRUM, a coarsely woven bone which surrounds the original long bone cortex (and which normally is easy to identify thought X-Ray analysis), and the CLOACAE/FISTULAE, oval or round-shaped openings which go thought the cortex (or even though the involucrum which could cover it) and which allow the drainage of the pus from the medullary cavity, where the bacteria originally caused the infection.

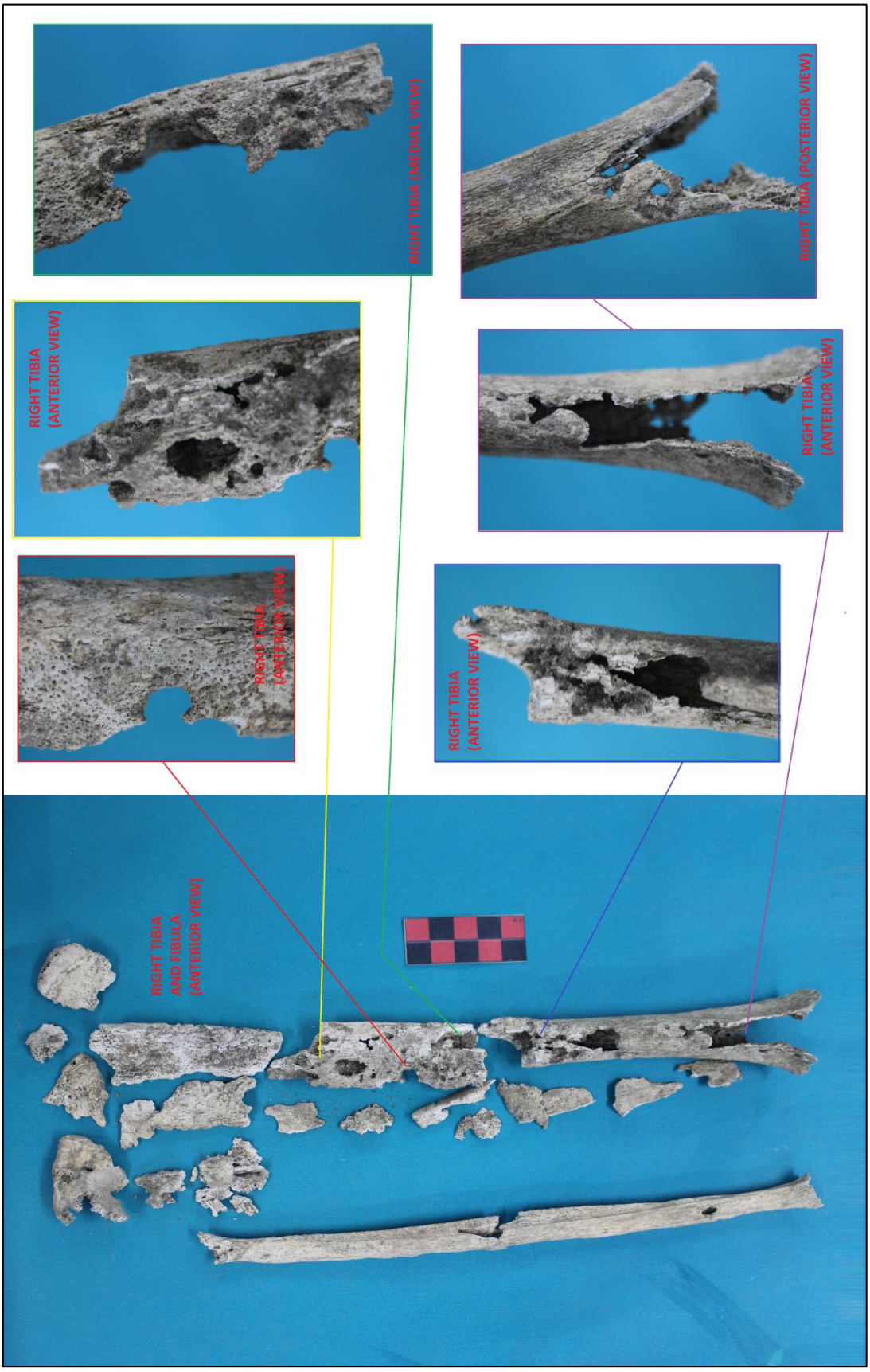
Since the presence of this characteristics are particular from this specific infectious disease (so the differential diagnosis is clear in this case), we had to discard the possibility of that the particular morphology of the bones was a consequence of post-depositional factors. The macroscopical analysis allowed us to identify the involucrum in all the described altered surfaces (the bones where fractured in this points, so the observation of the sections would allow us to see the differences in the texture between the original cortex and the new bone which surrounded it, much more woven), so we could discard the taphonomical explanations.

X-Ray analysis was also committed over all the bones in which the pathological markers where identified macroscopically, giving again positive results: both the cloacae and the new bone growth where identified.

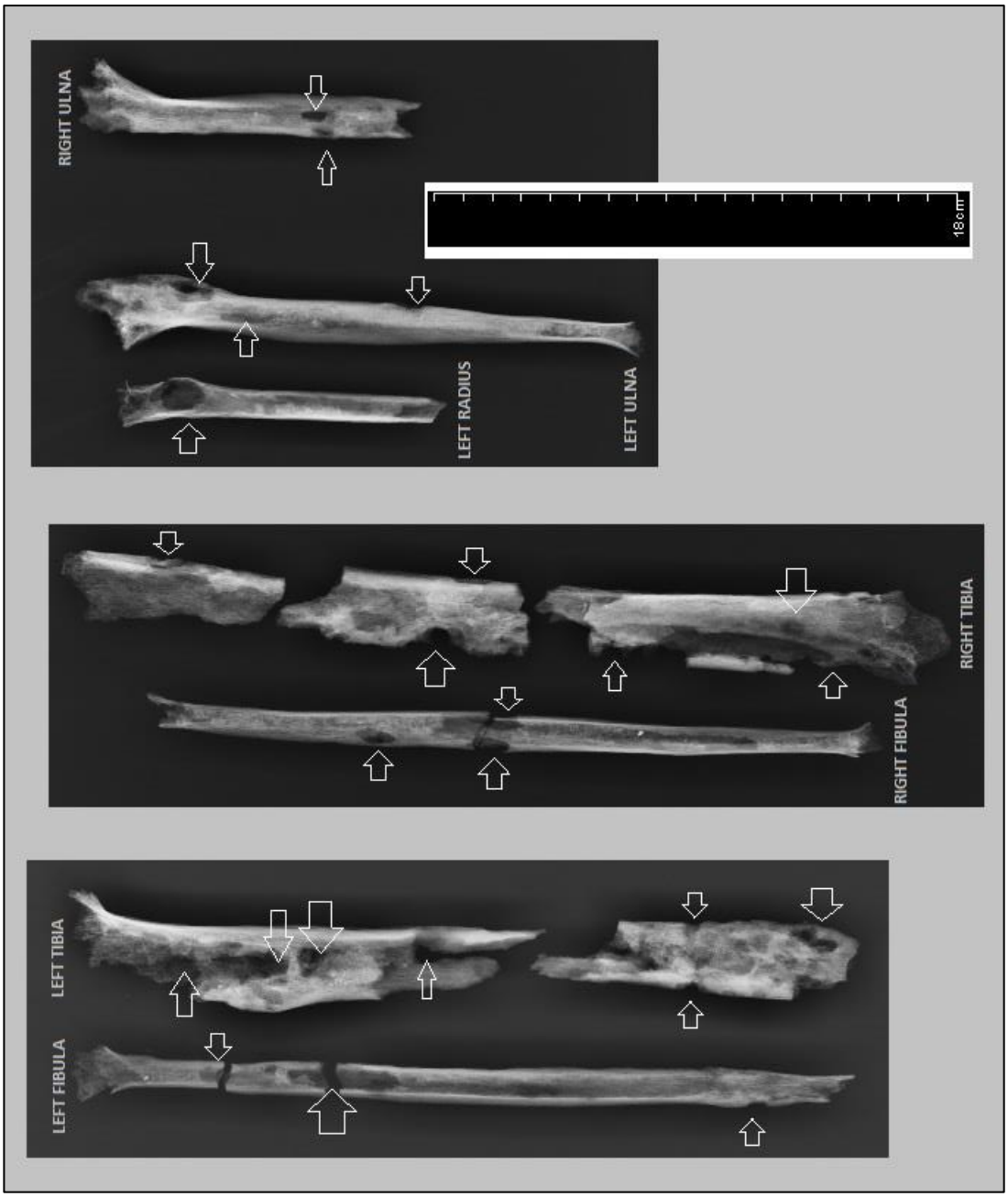


Details of the several cloacae registered in both forearms. A): left ulna and radius fragments. B): right ulna. In both cases, the involucrum is also visible, affecting mainly the proximal epiphysis.

Detailed pictures of the cloacae and involucrum registered over the left tibia and fibula of the skeleton from the context 703.



Detailed pictures of the cloacae and involucrum registered over the left tibia and fibula of the skeleton from the context 703.



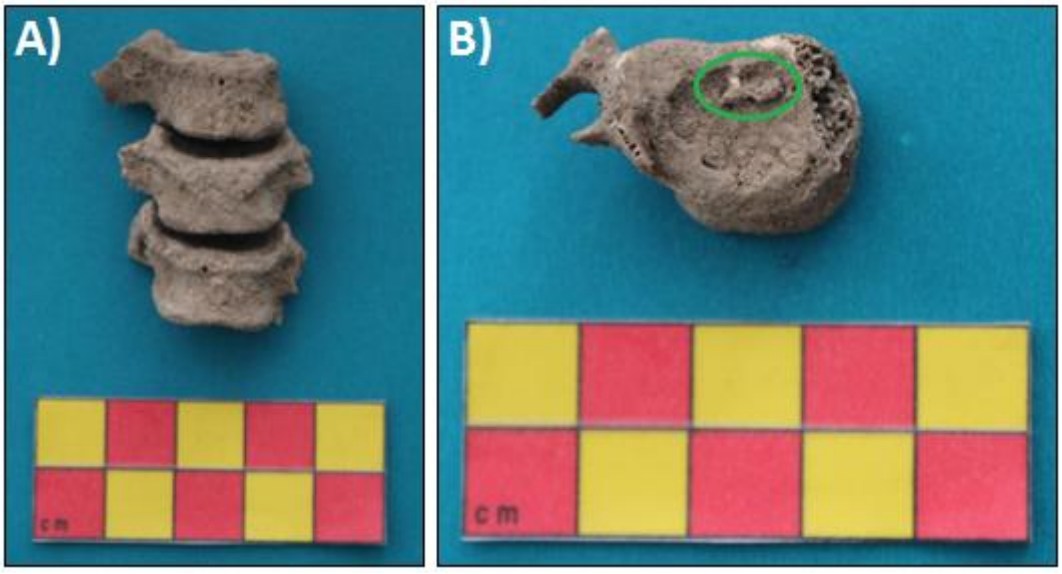
X-Ray: bones of the individual from context 703 (all anterior views) which presented positive results for osteomyelitis. The white arrows point to the several cloacae for pus drainage.

BIOLOGICAL PROFILE II (PALEOPATHOLOGIES).	CONTEXT Nº: 727

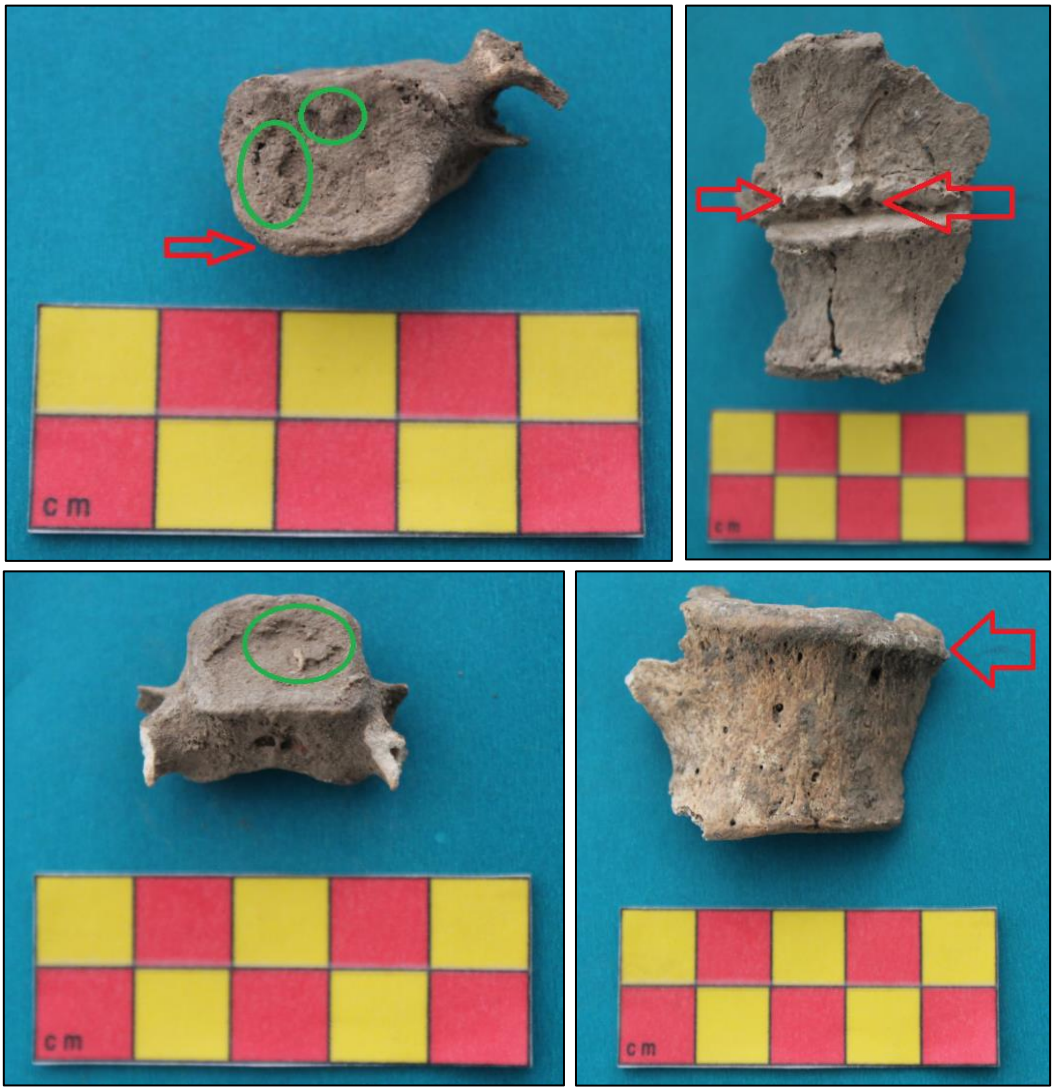
- DEGENERATIVE JOINT DISEASES.

In the case of the context 727 of Ille Cave, we could diagnose that suffered a case of **OSTEOARTHRITIS**, which, in this case, was located just in the vertebral column area (not possible to find signs of the disease in any other joint). Normally the disease manifest in three peculiar aspects, which we can see below:

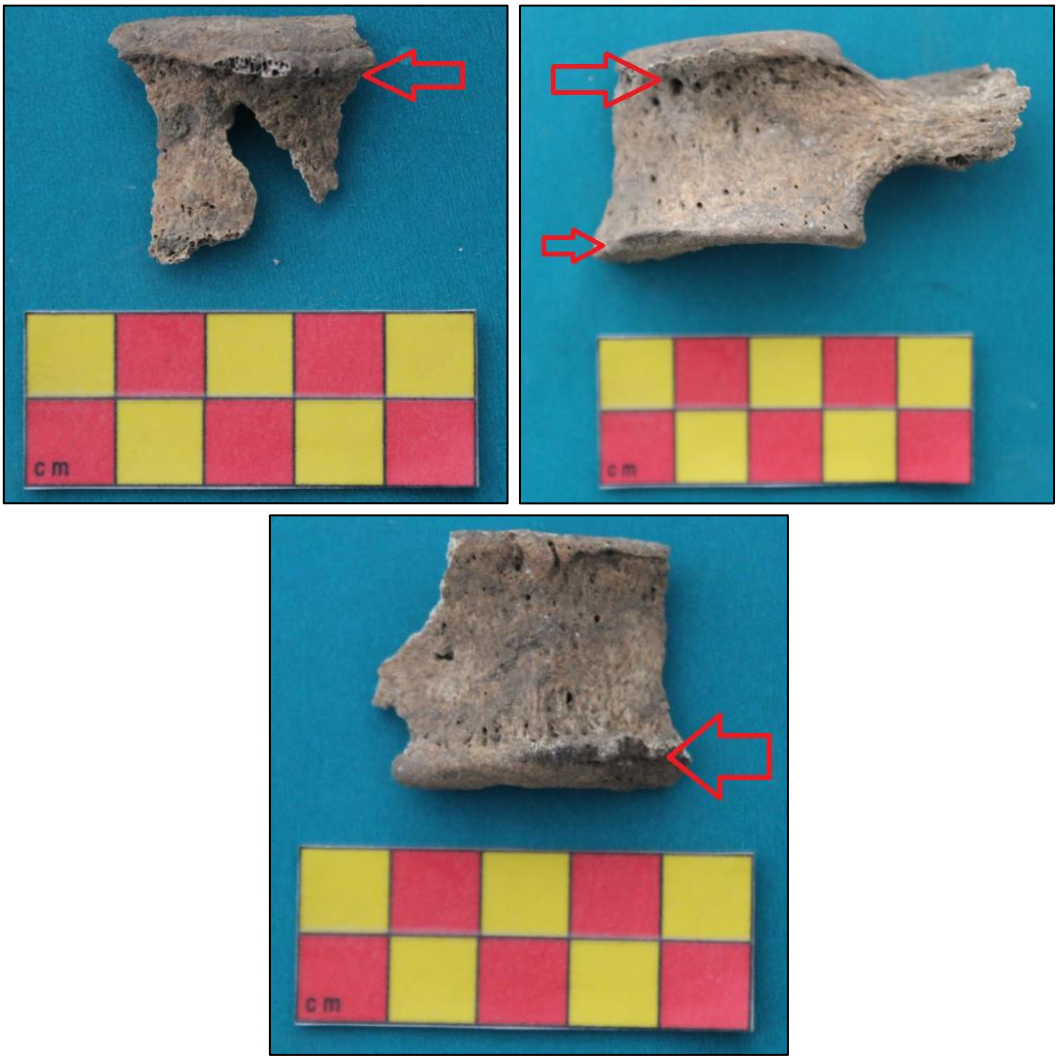
ASPECT	LOCATION
Osteophytes and bonny plaques	Small nodules of reactive bone where documented in the surface of several vertebrae (cervical, thoracic and lumbar areas), normally over the superior and inferior surfaces of the vertebral bodies. **Marked in green color in the following images.*
Marginal lipping	Located in several vertebrae, especially in the ones ascribed to the last thoracic and the lumbar ones. The lipping is generally associated to the edges (superior and inferior) of the vertebral discs, growing laterally from them as consequence of the mechanical action between the surfaces of both following bones, caused by the lost cartilage of the joint between them. **Marked with red arrows in the following images.*
Eburnated surfaces	In this case we couldn´t find any case, since the taphonomical conditions (concretions all over the surface) didn´t allow us to make a deeper analysis over the bones.



A): connected vertebrae from the cervical area. B): osteophyte over the superior vertebral body of one of them (marked in a green circle). Notice that the bad preservation status didn´t allow us to determine the exact position of each bone inside the vertebral column.



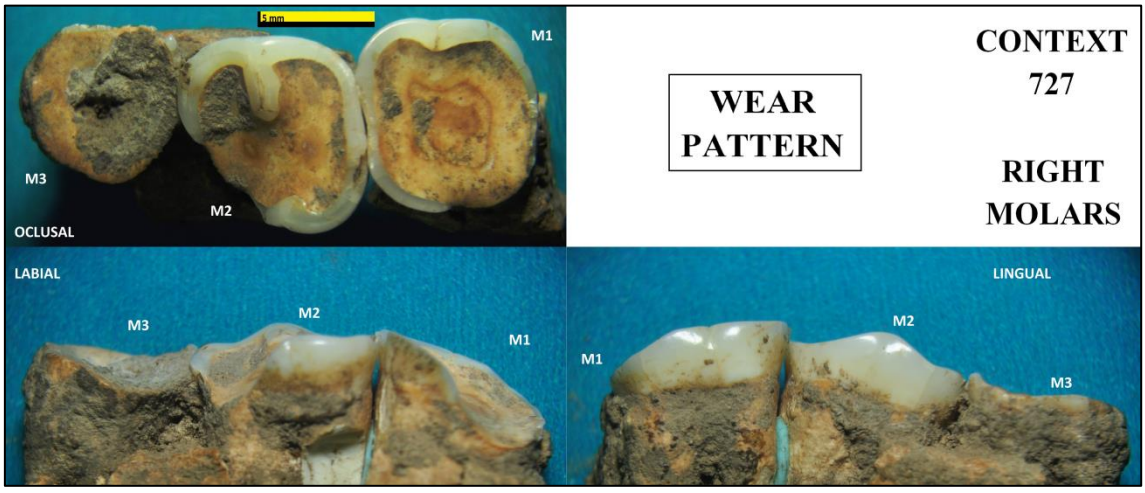
In this serial of photography, we can see several cases of osteophytes (marked in Green circles) and marginal lipping (red arrows) over the bodies of several vertebrae. All the cases seem to belong to the thoracic area, but is not possible to determine the correct anatomical order, cause of the bad conservation status of the spine.



Another three cases of marginal lipping (marked with red arrows) documented in the vertebral body edges of several vertebral fragments (thoracic-lumbar area).

- DENTAL DISEASES.

The first fact which called our attention over the dental pieces of this individual was the strong level of **EROSION OF THE TEETH WEAR**, clearly visible in all the dental pieces (missing morphology and enamel), but which affects specially to the molars, and in a higher grade to the ones of the mandibular side (inferiors). Some interesting facts about this particular erosion kind let us to associate this wear case to some kind of activity (maybe holding ropes or fibers with the molars?): the third molar was much more eroded than the first and the second one in both sides (which is quite strange, since is the last dental piece in erupt), losing completely all its crowns (which still a little bit visible in M2 and M3), and with a different siding than the other teeth (the erosion surface sides to the front, meanwhile in M2 tends to be lateral or goes to the interior of the mouth). Beneath all the possible explanations for this phenomenon, we have associated this case to a **POSSIBLE CONSUMPTION OF BETEL NUT**, since the wear pattern is similar to other ones proceeding from archaeological register (see main text, Chapter 4) and it has also been documented in macro-botanical register of our site.



The wear pattern registered in the molars of both sides of the mandible make us thought about a possible case of abrasion, owned to some kind of human activity. In the image we can see the case of the right molars, in occlusal, labial and lingual aspects.

Is also interesting the **TEETH ROOT EXPOSURE** (possible case of periodontitis?), caused by the alveolar bone recession of both maxilla and mandible. This disease is particularly easy to verify in the case of the incisive, canines and premolars of both sides (both mandible and maxilla are quite fragmented around the molar area, so is not possible to determine if the visibility of the roots is caused because of a pathology or because taphonomical reasons).

It has been also documented a case of **DENTAL ENAMEL HYPOPLASIA**, characterized by the typical transverse lines and grooves on the surface of tooth crowns, clearly visible in this case in all the four canines (mandibular and maxilla) and in three of the mandibular incisives (RI1, LI1 and LI2). The strong tooth wear level and the calcium carbonate which cover all the surfaces made impossible to analyze the rest of dental pieces in order to determine its presence in all the teeth, but microscopical analysis was made over the seven dental pieces in order to clarify the diagnosis, with positive results.

The presence of **CALCULUS** (mineralized dental plaque) in almost all the dental pieces (both inside and outside the mouth cavity, in a yellowish color) is also an interesting sign of possible infections, but we couldn´t find any other sign (reactive bone, irregular or granulose surfaces, porosity, etc) which could help us to determine the presence of a clear case, once again because of taphonomical reasons. The calculus are present in the sides of tooth crowns, both in mandible (RI1, RI2, LI1, LI2, RC, LC, RPM1, RPM2, LPM1, RM2, RM3) and maxilla (RI1, RI2, LI1, LI2, RC, LC, RPM1, LPM1, LPM2, RM2, LM1, LM2).

- NON-METRIC TRAILS.

Finally, was also documented a case of non-metric trails, which manifest in the maxilla in the shape of a too big mental foramen in both sides.

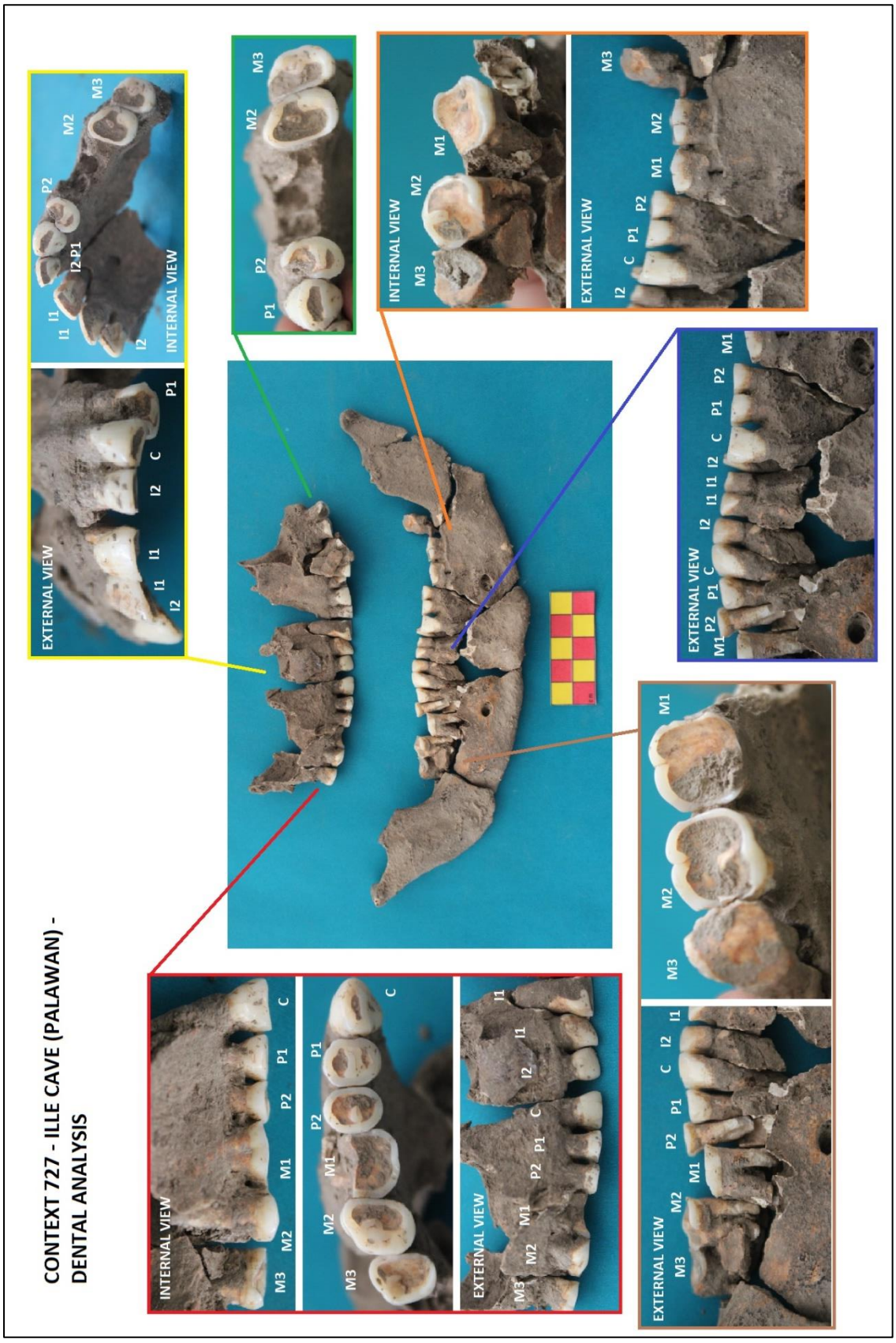
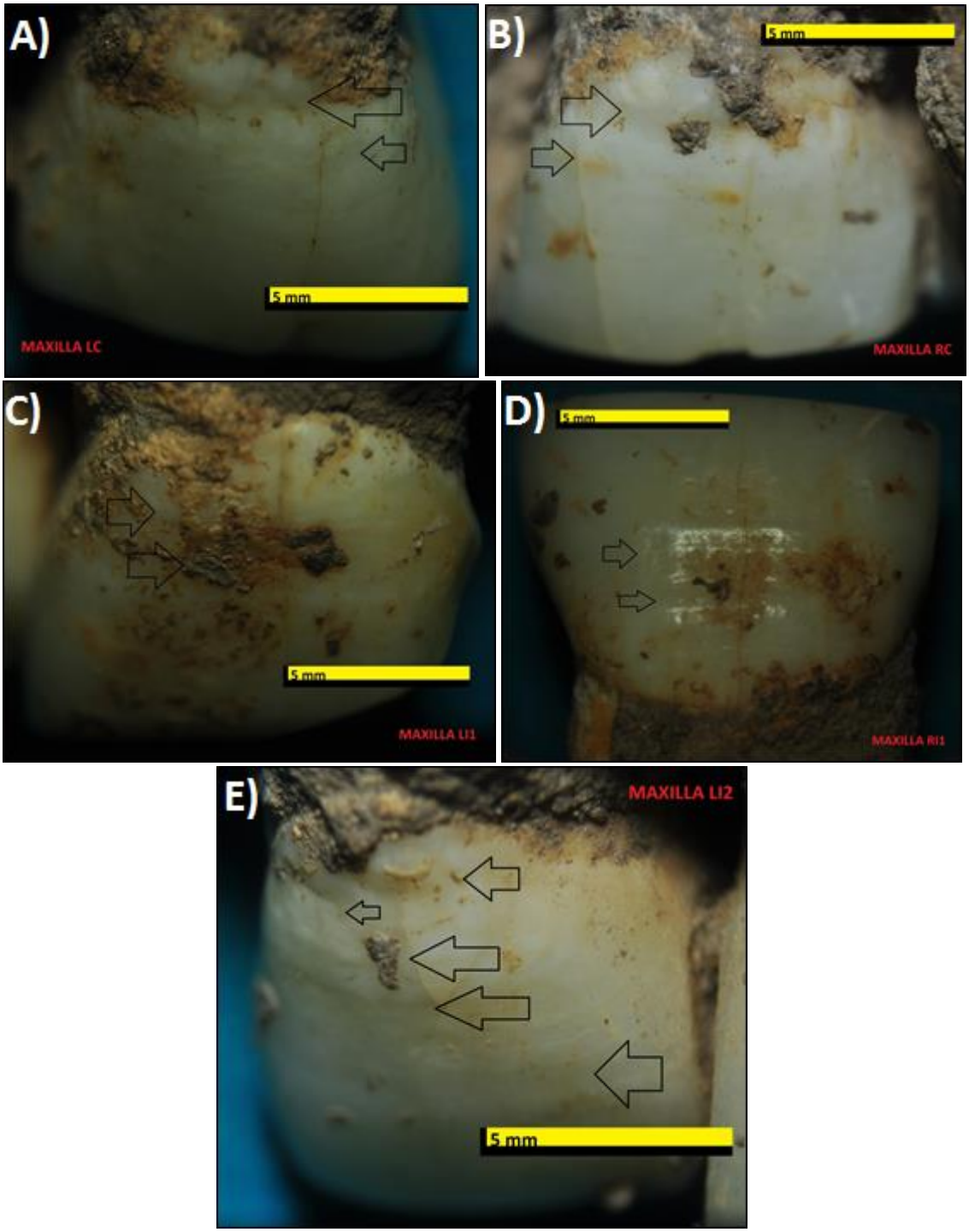
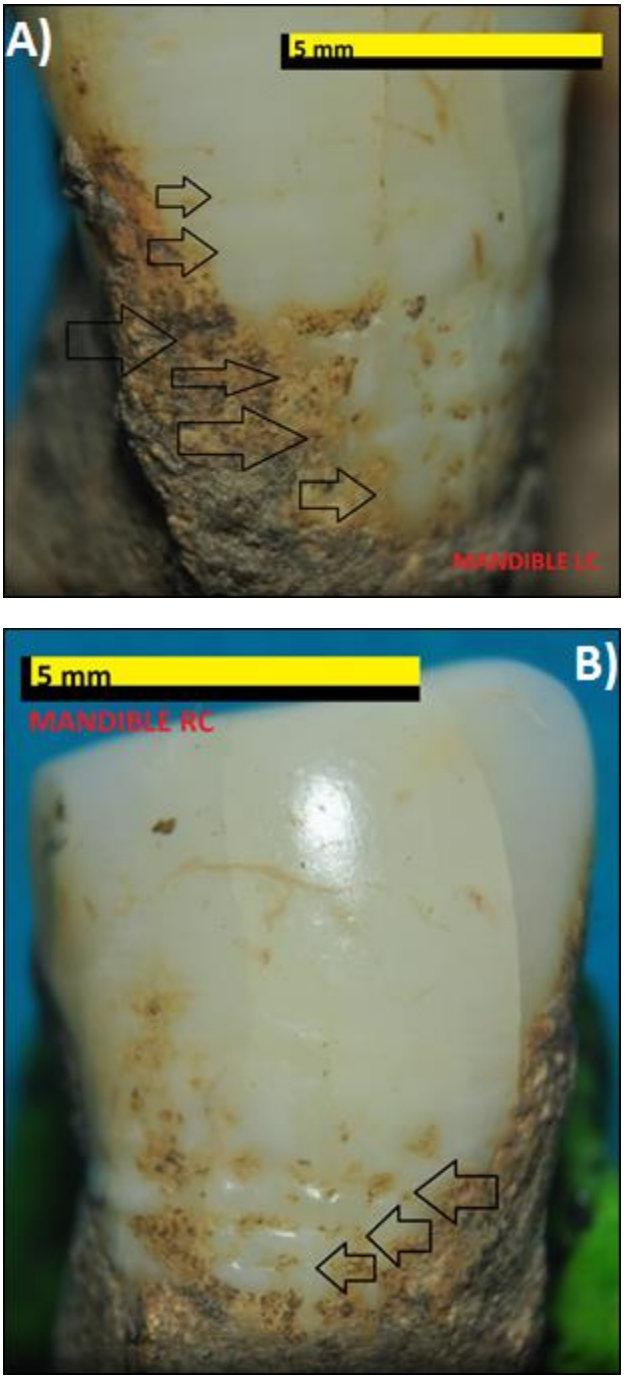


Chart which displays the buccal reconstruction of the individual 727, including all the dental pieces. We can observe the teeth wear patterns, being especially interesting the one present in the mandibular molars (possibly caused by activity), and also the calculus distribution ant the exposition of the roots. Also interesting the big mental foramen (non-metric trail).



Results of the microscopical analysis made over several maxillary dental pieces of the skeleton in the context 727, in which we can appreciate the typical transverse lines of DEH. From A) to E): maxillary LC and RC, LI1 and RI1, and LI2 at the bottom. Notice that RI1 is displayed upside down (photographical reasons: the microscope light worked better in this position, making easier the register of the pathology).

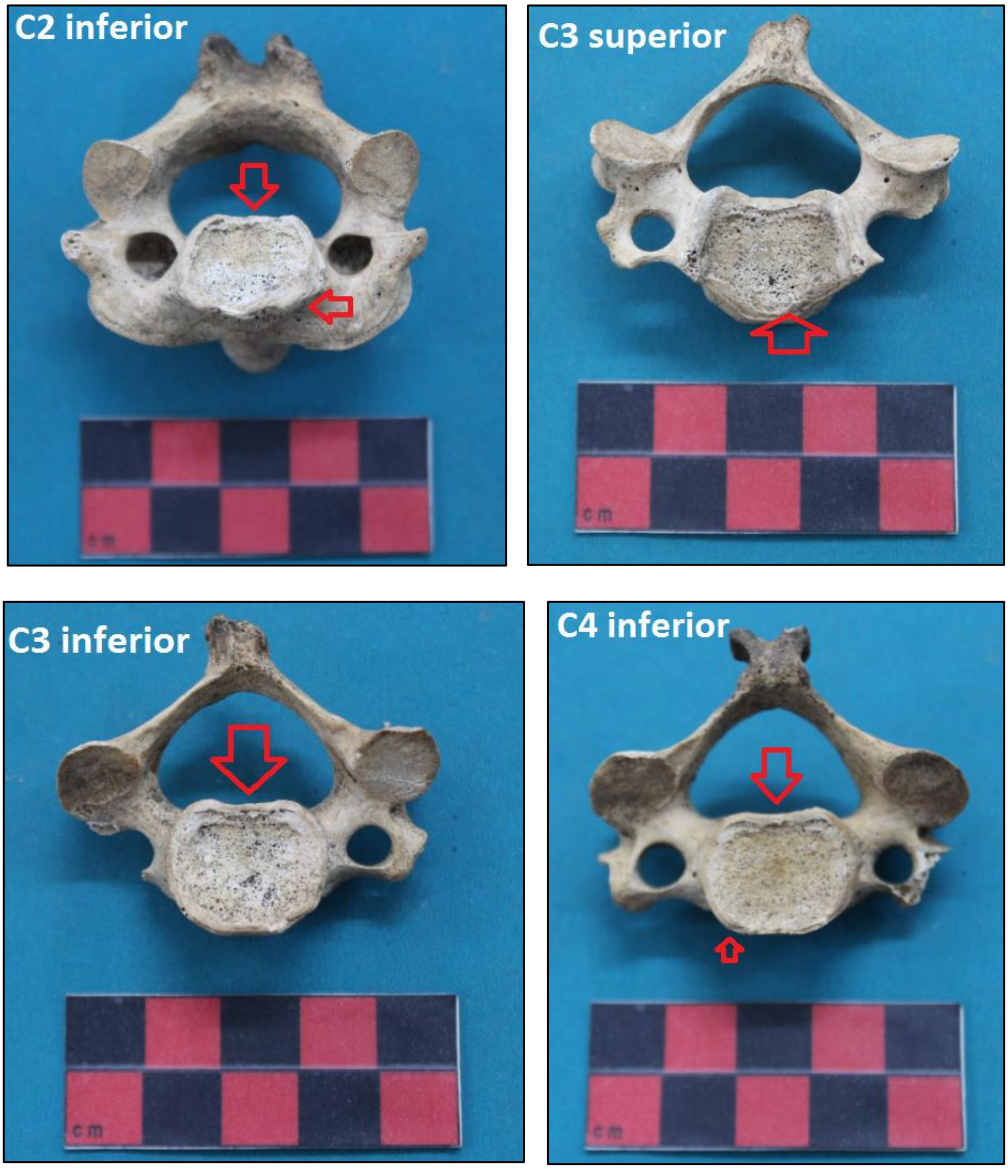


Results of the microscopical analysis made over mandibular canines in the context 727. We can appreciate the transverse lines typical in DEH, both in the left side (A) and the right one (B). Please notice that both pieces are presented here upside down.

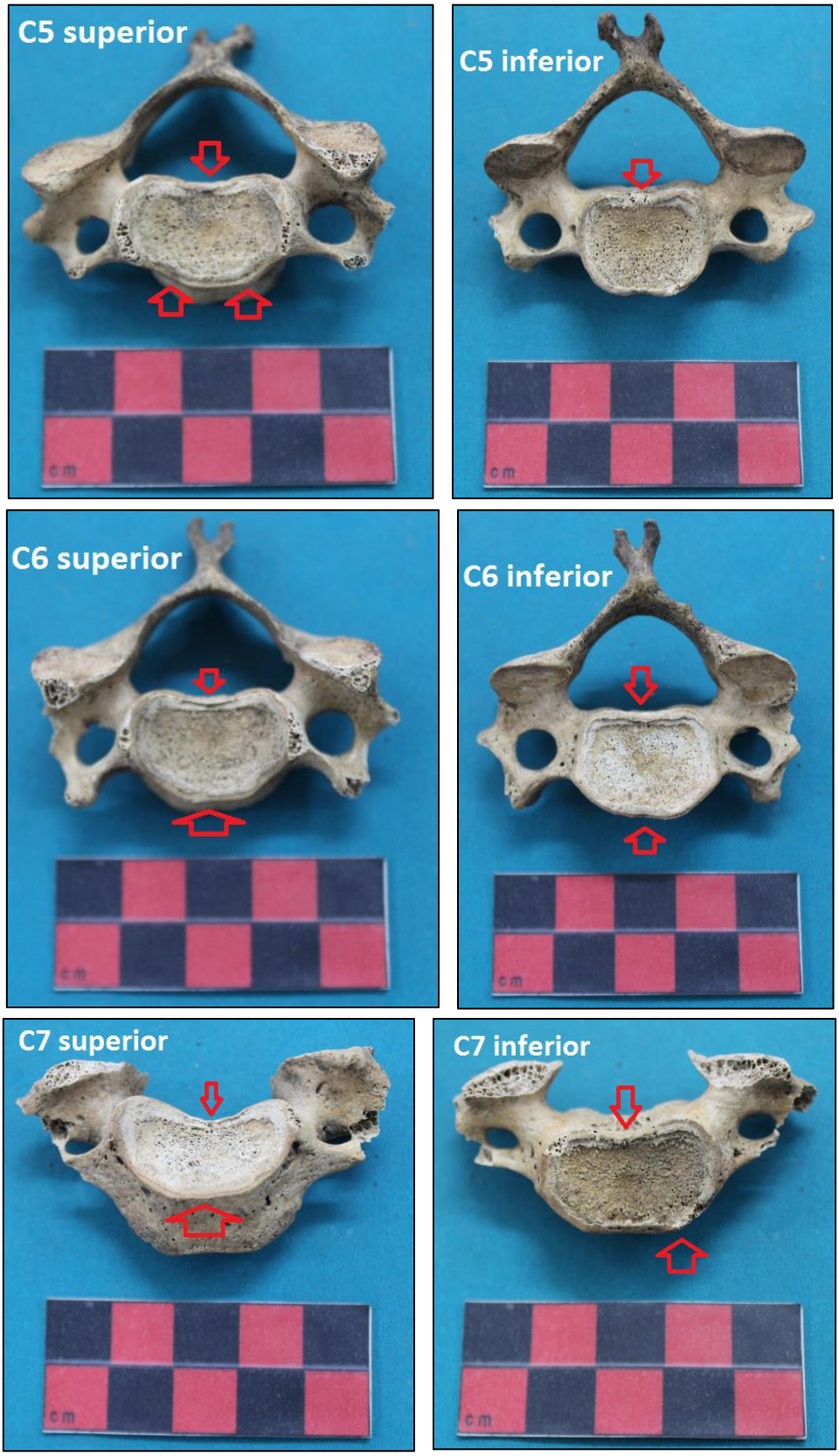
BIOLOGICAL PROFILE II (PALEOPATHOLOGIES).	CONTEXT Nº: 755

- DEGENERATIVE JOINT DISEASES.

In the case of the context 755 of Ille Cave, we could observe some cases of **MINOR MARGINAL LIPPING** in all the cervical vertebral bodies surfaces after C2 (included), but we can´t speak about any proper joint disease. For example: the most common case, the osteoarthritis, manifest presence of bone lipping, but is normally linked to other aspects (osteophytes, bonny plaques, eburnated surfaces, etc) which are not present in this study case.



Light marginal lipping documented in the vertebral bodies of C2-C4.



Light marginal lipping documented in the vertebral bodies of C5-C7.

- DENTAL DISEASES.

The first fact we tried to analyze in the dental pieces of the individual of the context 755 from Ille Cave was the **TEETH WEAR**, clearly visible in all the dental pieces preserved, which missed their original shape with the consequent missing of the enamel and, in some cases, even part of the dentine.

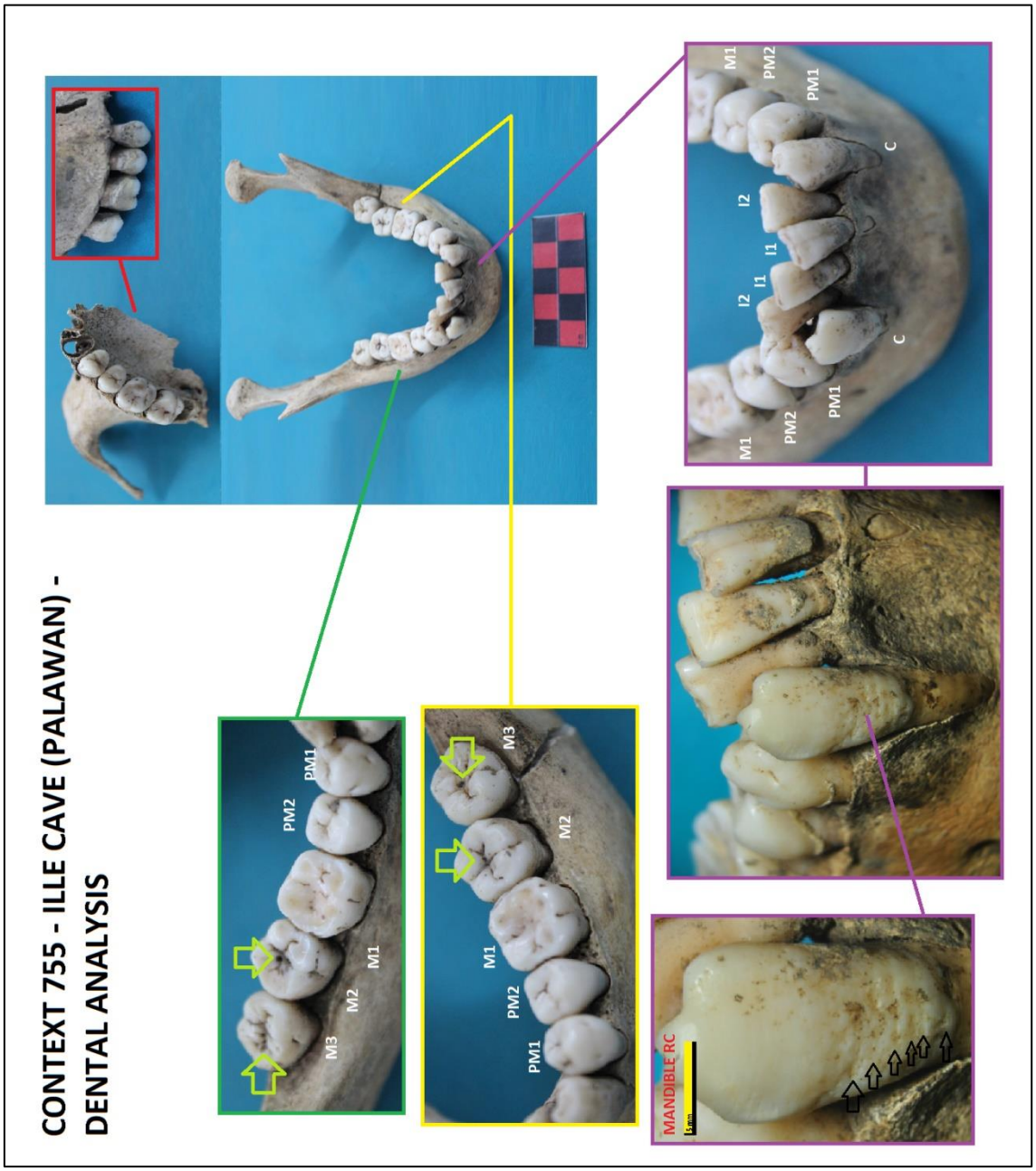
We could observe the effects of the ATTRITION in the molars of both sides of the mandible, and as well in the teeth preserved from the right maxilla (RPM1-RM2). The teeth wear is quite light, since the individual is still young, as we can appreciate thought the fact than the enamel is just starting to appear in the first molars.

At the same time, we observed that the wear pattern from the frontal teeth of the mandible (incisives, canines and premolars) was different: it didn´t affect the surfaces with an horizontal pattern as in the molar crowns, or in the typical oblique shape that the attrition causes in this part of the mouth. Instead, the curved pattern of erosion in the labial aspects of this teeth, suggested a case of ABRASION which remembered us the case of the context 2247 of Ille Cave (as we can see in its pathological summary, a similar wear case which pointed to a **POSSIBLE CASE OF USE OF THE FRONTAL TEETH AS THIRD HAND** associated with some specific cases of cultural activities, like the **WORK OF ANIMAL SKINS AND LEATHERS**, as deduced from cultural parallelisms with native populations still alive). Unfortunately, the microscopical analysis in this case didn´t show us any mark (vertical sulcus, micro-fractures, chipping, etc) which allowed us to point so clearly to this kind of activities, so we have to be cautious with this case.

Also we could notice the presence of **TEETH ROOT EXPOSURE** in this individual, caused by the alveolar bone recession of both maxilla and mandible, and which appeared together with a little of **REACTIVE BONE** and **POROSITY** around all the alveolar process of both maxilla and mandible. All this facts together could point to a case of infectious disease, more specifically to a possible case of periodontal disease.

The idea of the buccal infection gains weight if we notice also the presence of some **CARIES** which started to appear in the occlusal surfaces of the mandibular molars (RM2, RM3, LM2 and LM3), even if the tissue still shows a small level of damage (just some small pits which affect mainly to the dentine). Also **CALCULUS** was noticed in all the dental pieces preserved, distributed horizontally in bot labial and lingual aspects.

Finally, it has been also documented a case of **DENTAL ENAMEL HYPOPLASIA**, characterized by the typical transverse lines and grooves on the surface of tooth crowns, clearly visible in this case in the RC labial aspect (mandible). The other dental pieces doesn´t show it clearly, since are covered with the calculus and their surfaces are affected by the described wear pattern, but the microscopical analysis made over this individual tooth makes clear the diagnosis.



Dentition of the context 755. We can observe the labial-buccal accumulation of calculus in the different teeth, the curved wear pattern of the frontal teeth (possibly because of the use of the mouth as third hand for some activities), the root exposure and the signs of infection in the alveolar bone in the mandible. Also, marked with green arrows, several caries in the mandibular molars, and in black arrows some horizontal grooves in the RMC which prove the diagnosis of DEH.

BIOLOGICAL PROFILE II (PALEOPATHOLOGIES).	CONTEXT Nº: 800

- DEGENERATIVE JOINT DISEASES.

This individual also had an interesting case of exostosis over bone surface: a small bonny plaque of new bone tissue (HYPEROSTOSIS) was formed in the right clavicle sternal end. We couldn´t determine if we are facing just new generated bone or maybe a process of calcification over the soft tissues of the sternoclavicular joint, but in any case both process appear normally together in joint pathologies.

We determined that we were facing a **PROBABLE CASE OF STERNOCOSTO-CLAVICULAR HYPEROSTOSIS**, a rare pathology which can appear in this area sometimes, and in which both new bone growth and ossification of articular soft tissues are present. We based our differential diagnosis in two other similar pathologies which can manifest in the same area and with similar markers:

- Osteochondroma/osseocartilaginous exostosis: a kind of benign tumor that is really rare in clavicles. Is associated with a differential growth of the medial clavicle, which we can´t determine here (missing) and with the presence of reactive bone around the clavicle´s epiphysis (not just in the joint surface itself), which we didn´t record in this case.
- Aseptic osteonecrosis, different arthropaties, etc: the also present erosion and/or degeneration process aver the joint surfaces, process which didn´t appear in our case.

Anterior and lateral views of the right clavicle sternal end of our individual, in which we can appreciate the growing of new bone (exostosis), right in the center of the sternal articulation (whitish coloring).

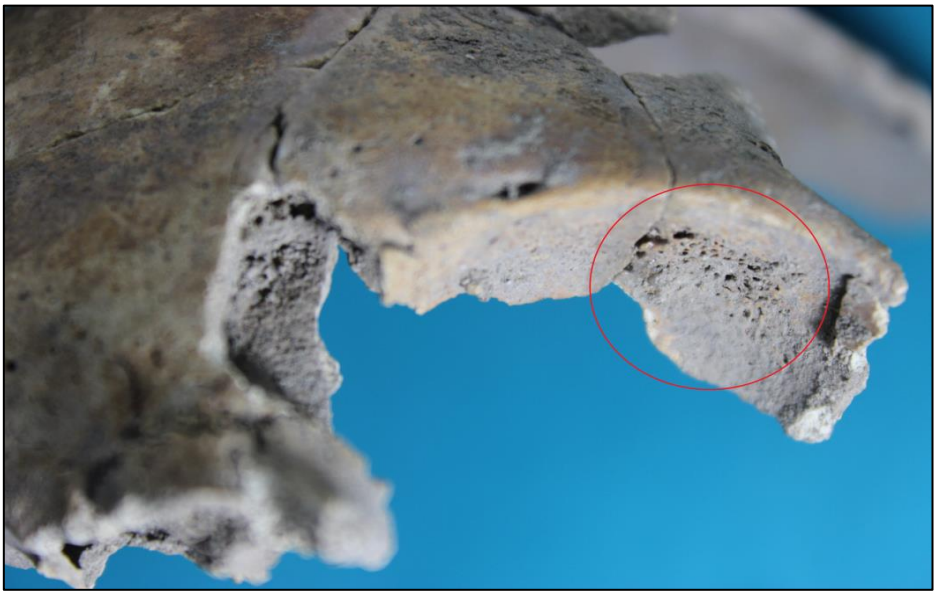
- DENTAL DISEASES.

No dental diseases where documented in this case because of the poor conservation status of the bones (concretions all over the surfaces and almost all the maxilla is disintegrated, plus the middle part of the mandible is missing). About the **TEETH WEAR** of this individual, we could observe that the erosion of the dental pieces affected lightly just some surfaces, always occlusal, which could be a consequence of the natural **ATRITION**.

Dentition of the context 800. As we can see, the attrition caused a horizontal wear pattern over the occlusal surfaces of the molars. We didn´t record any wear pattern which could point to any kind of dietary information or activity reason. No other pathologies documented.

- METABOLIC DISEASES.

Also, the skeleton from the context 800 of Ille Cave presented a concentration of porosity in the right supraorbital ridge (the left one is not present). We immediately determined that should be a pathological sign, since the porosity appeared located in a concentrated shadow in the orbit roof, while the rest of the bone surface had no any other kind of marks. We determined a case of **CRIBRA ORBITALIA**, since this kind of porosity accumulations around the orbital roof are a characteristic landmark of this pathology.



Cribra orbitalia over the right orbit roof of the individual 800 from Ille Cave (marked in the red circle).

- NON-METRIC TRAILS.

We could observe the presence of a symmetrical non-metric trail in both patellae: a significate vastus notch.

Anterior and posterior views of both patella of the individual from the context 800, in which we can observe the presence of bilateral vastus notches (non-metric trail).

BIOLOGICAL PROFILE II (PALEOPATHOLOGIES).	CONTEXT Nº: 907

- DENTAL DISEASES.

The first fact we tried to analyze in the dental pieces which we could ascribe to this individual (the context included extra dental pieces, and the conservation status of both mandible and maxilla didn´t allow us to determine in some cases which one of the possible options was actually part of the individual, so we decided to base our study in the few one which surely where part of it) was the **TEETH WEAR**. The occlusal surfaces of the teeth showed an advances level of erosion, which showed concavities in the crowns of the molars. We assumed that was a consequence of an intense ATTRITION case, which normally develops these concavities in the occlusal surfaces (when the wear arrives to the dentine, which degenerates faster than the enamel). Since no signs of activity patterns where founded, we can´t speak about any kind of activity signs, but is possible that the wear process was stronger and faster cause dietary reasons (abrasive food?). In any case, since almost all the dental pieces are missing, once again we should be cautious about these ideas.

Another feature that we could observe in this individual was an advanced level of **TEETH ROOT EXPOSURE**, with a strong recession of the alveolar bone, which also seemed to show signs of a possible infection (**POROSITY** and **CALCULUS**). All this could be signs of a possible periodontitis, but in any case would be quite light compared to the one documented in other individuals of Ille Cave (the calculus is really light and affects just to some pieces, the alveolar process presents a lighter porosity, etc). Again, since almost all the dental pieces are missing, we can´t determine more than the fact of that this signs are markers of a possible infection, but we can´t go deeper in our analysis.

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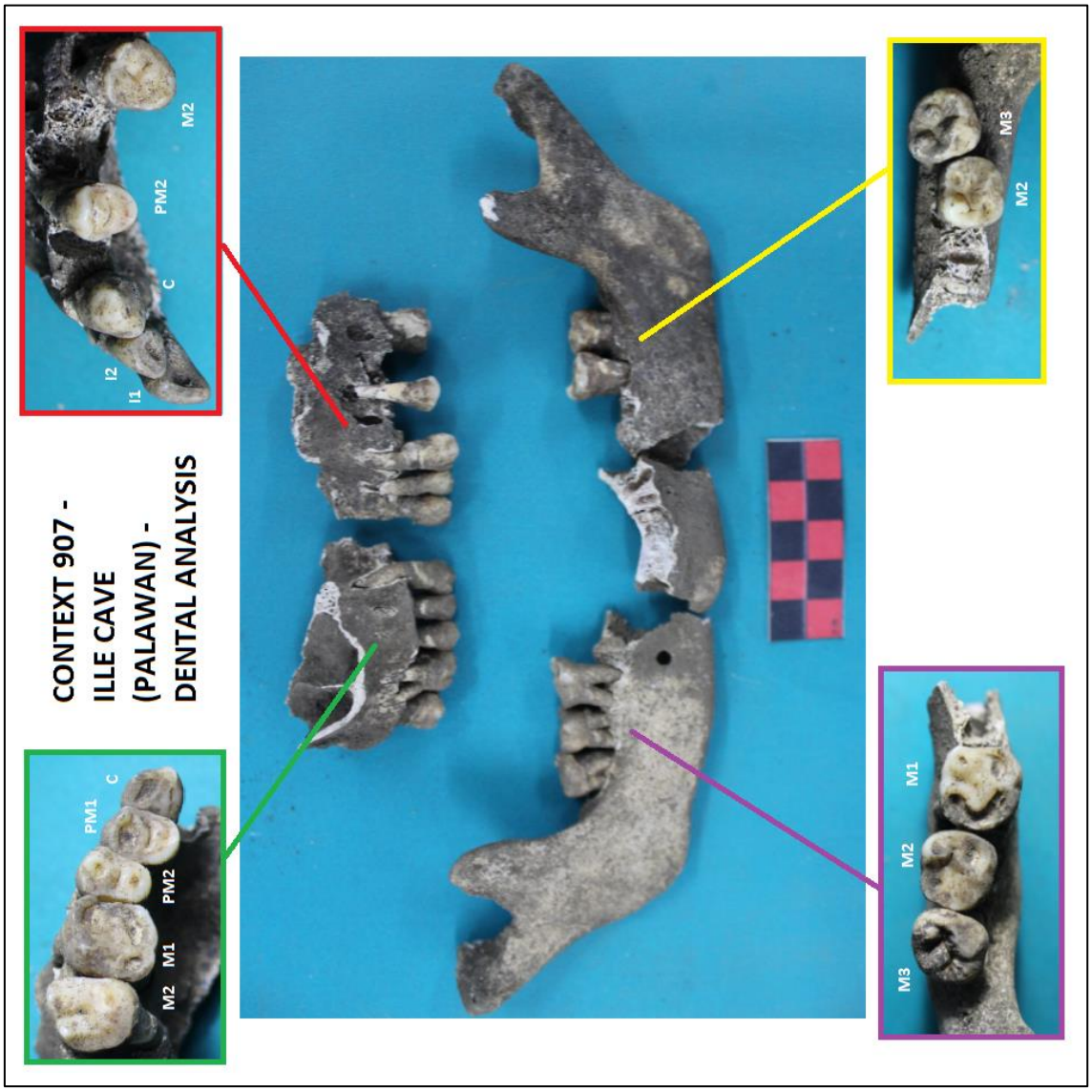


Dentition of the context 907. We can observe the occlusal wear pattern and the root exposure. Unfortunately, the conservation status (several missing pieces) ant the concretions of carbonate which cover all the surfaces, made impossible a deeper analysis in this case of study. Even like that, we were able to determine the presence of a thin calculus accumulation in the labial side of the teeth, and also some porosity in the preserved alveolar surfaces which could point to a possible buccal infection.

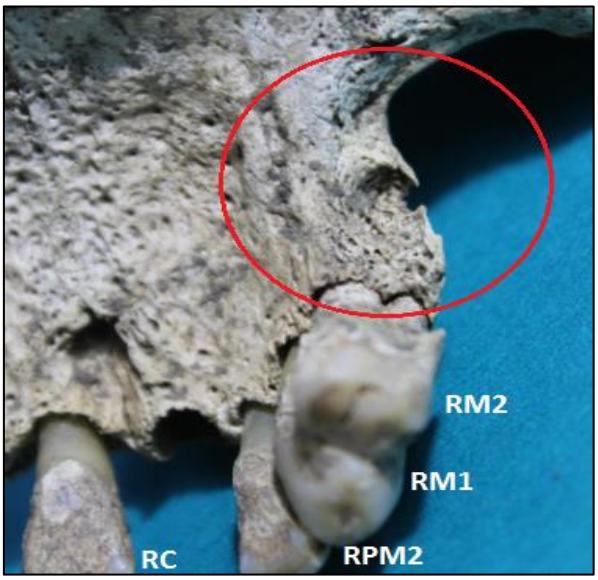
BIOLOGICAL PROFILE II (PALEOPATHOLOGIES).	CONTEXT Nº: 1337

- DENTAL DISEASES.

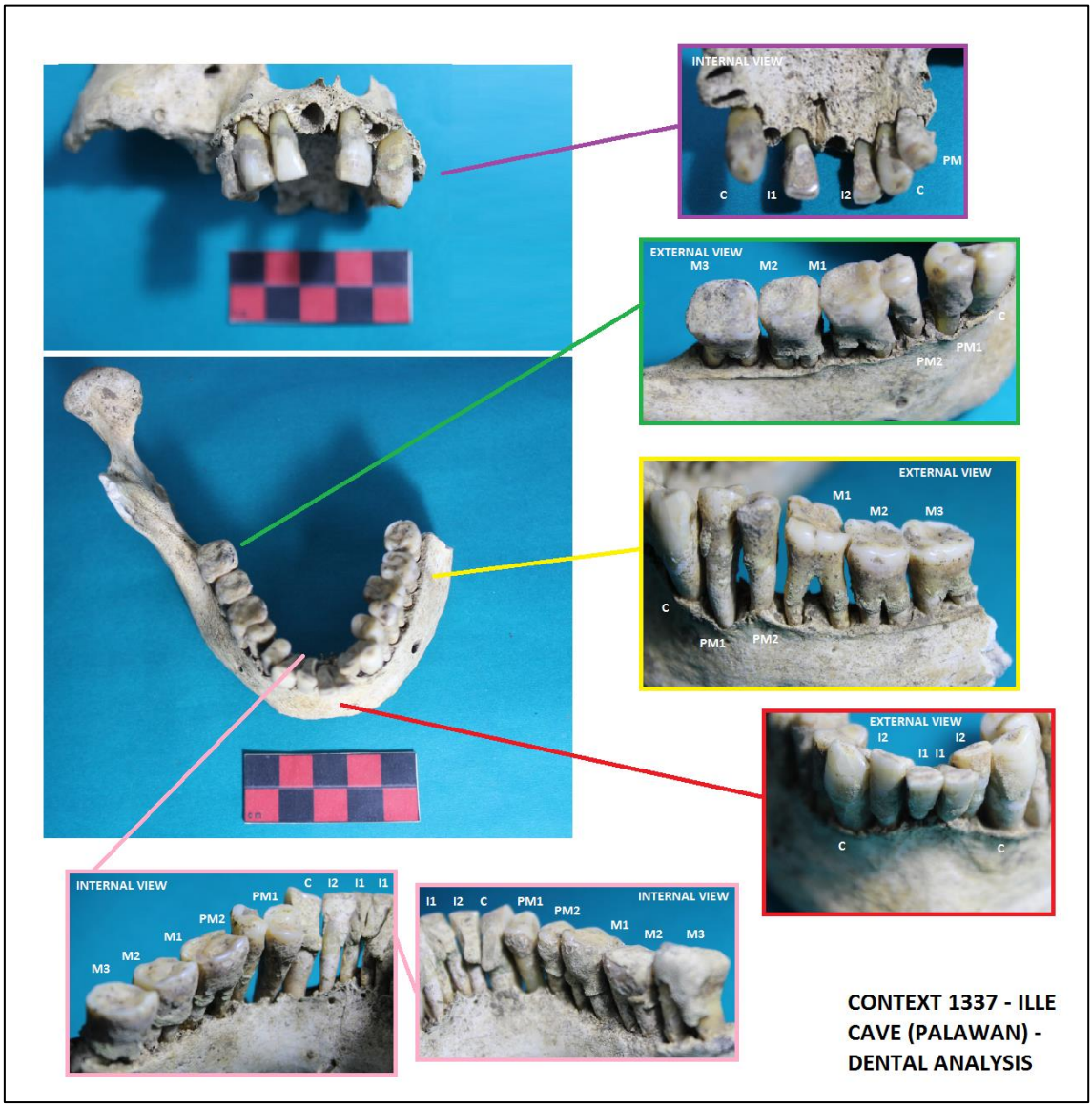
About the **TEETH WEAR** patterns of the individual 1337 from Ille Cave, we can just say here that we didn't notice the presence of any kind of abrasive material between the teeth (no marks of activity, nor dietary elements, which could break with the normal ATTRITION between opposite teeth, which is clearly resent here with the natural occlusal pattern: flat surfaces in molars and oblique ones in the frontal teeth).

We noticed again the presence of the **TEETH ROOT EXPOSURE** in this individual, caused by the alveolar bone recession of both maxilla and mandible, and which appeared together with a light case of alveolar infection, manifest thought the presence of REACTIVE BONE and POROSITY around all the alveolar process of both mandible and maxilla. All this facts together could point to a possible case of infectious disease, as also does the presence of **CALCULUS** deposits, which where noticed in all the dental pieces preserved, distributed horizontally in bot labial and lingual aspects. The calculus accumulated in the dental pieces of this individual is the most significate of all which we registered in our study of Ille Cave: specially in the buccal side of the mandibular incisives, the deposits of mineralized dental plaque where so big that they even made contact beneath them, giving an uniform appearance of the surface.

Another interesting fact that we could register in this individual is a complete process of **ALVEOLAR RIDGE RESORPTION** in the surface of the maxilla, where previously would have been the RM3, so we can determine that the individual lost this dental piece during his life time (*ante mortem*).

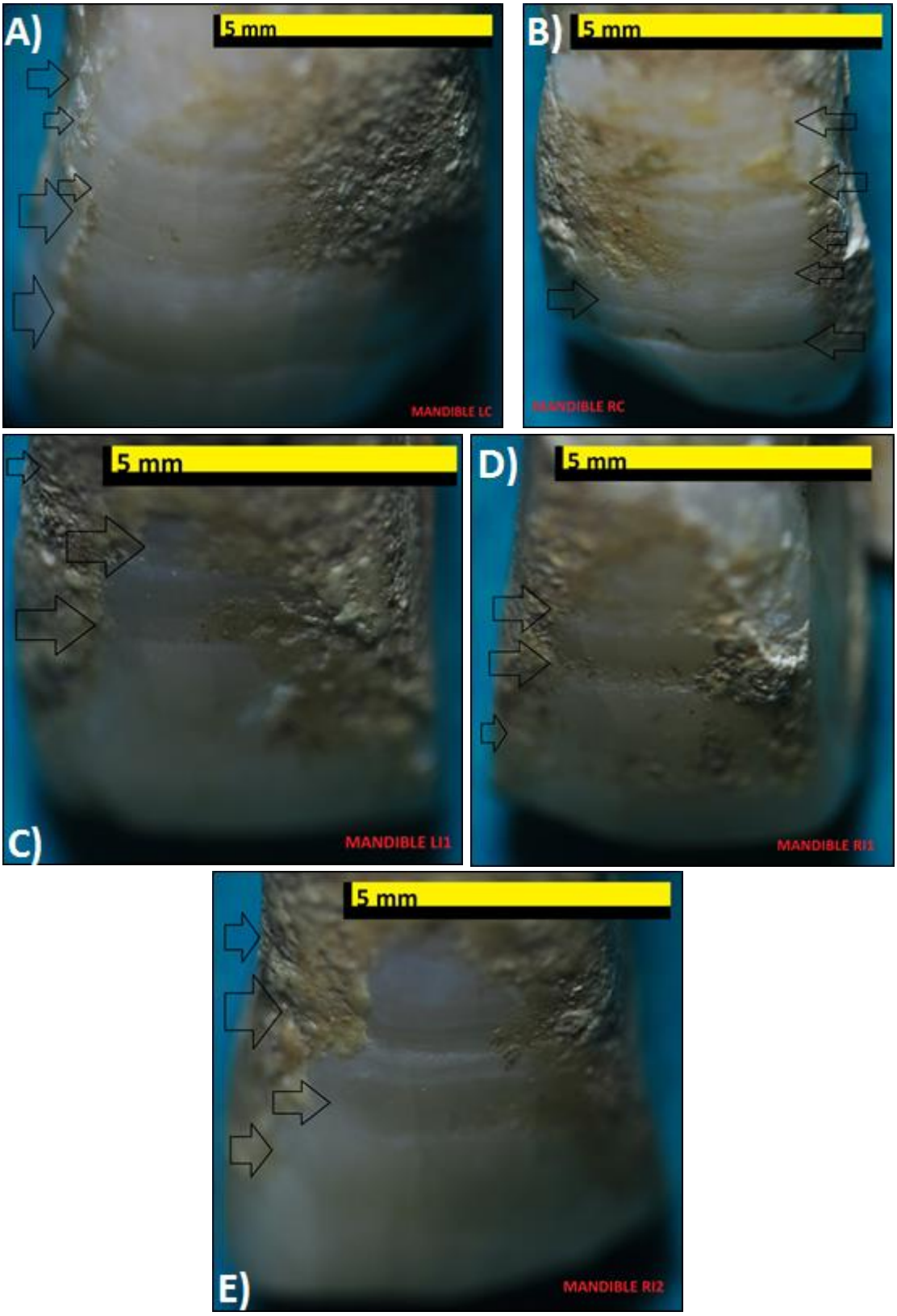


Detail of the maxilla of the individual 1337 (buccal view) in which we can observe the resorption of the alveolar ridge around the lost RM3 (red circle).

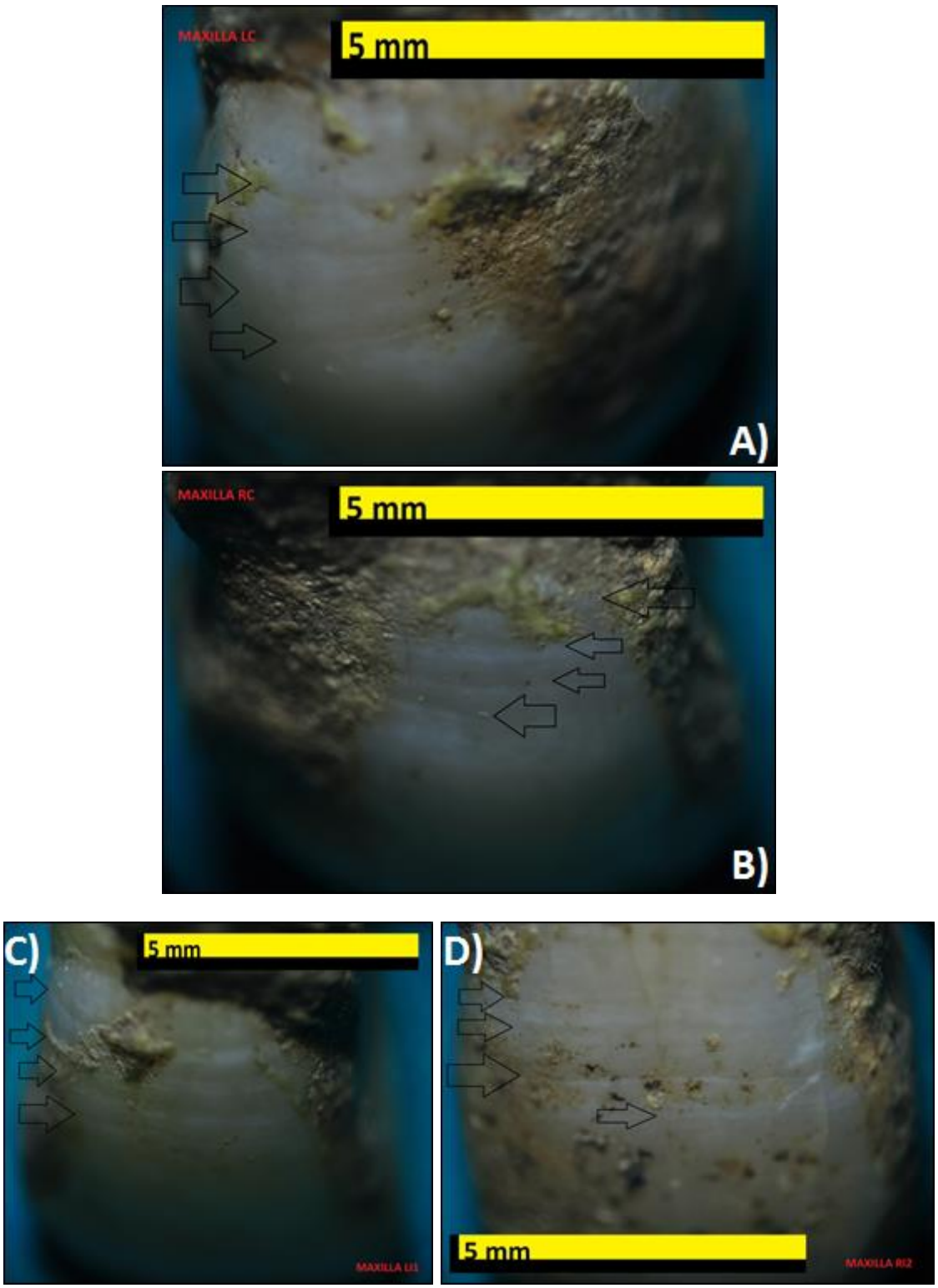


Dentition of the context 1337. We can observe the teeth attrition, the root exposure and the signs of infection in the alveolar bone in both mandible and maxilla. Notice also the big deposit of calculus over all the teeth, especially in the case of the lingual aspect of the mandibular incisives and canines (pink boxes).

Finally, it has been also documented a case of **DENTAL ENAMEL HYPOPLASIA**, characterized by the typical transverse lines and grooves on the surface of tooth crowns, clearly visible in this case in the labial surface of several dental pieces: in the maxilla, DEH was registered in LI1, RI2 and both C; in the case of the mandible, was founded in both I1, the right I2 and again in both C. As usual, microscopical analysis was done over all this teeth, giving positive results in all the cases studied.



Results of the microscopical analysis made over several mandibular dental pieces of the skeleton in the context 1337, in which we can appreciate the typical transverse lines of DEH. From A) to E): mandibular LC, RC, LI1, RI1 and RI1. Notice that the teeth are not displayed in anatomical position (their roots are pointing up), but upside down.



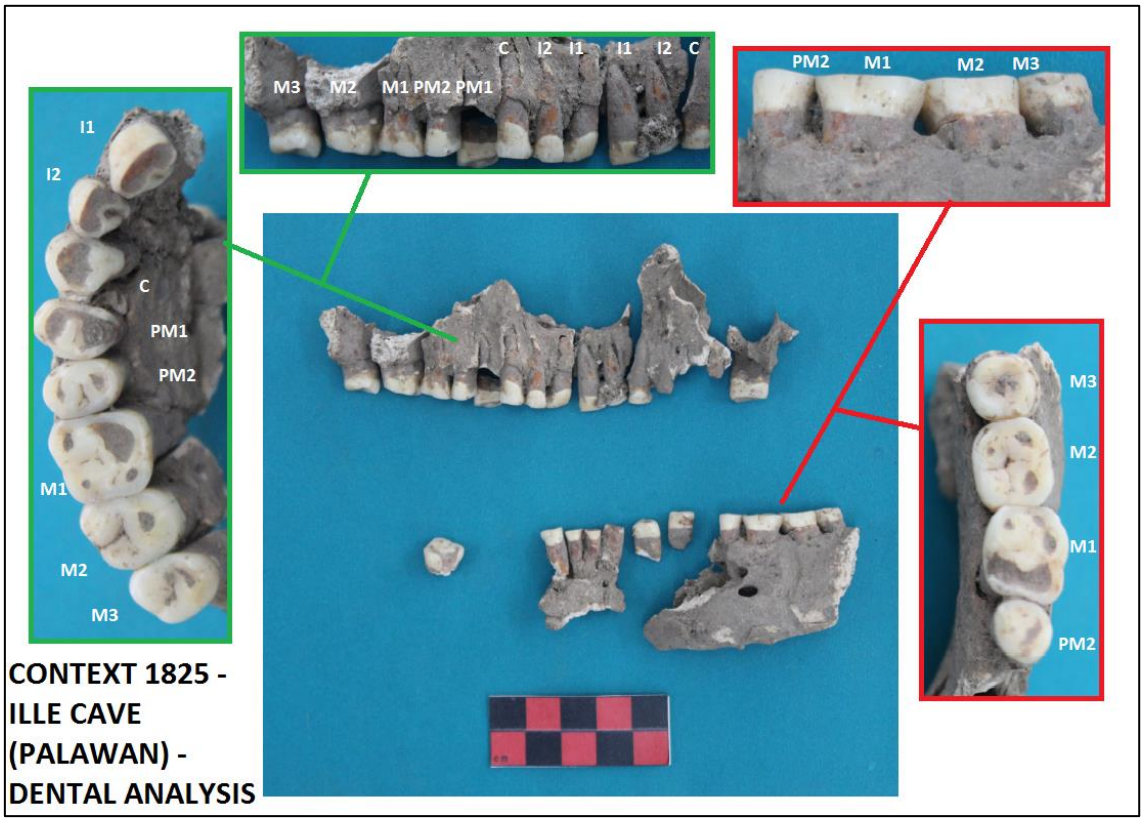
Results of the microscopical analysis made over several dental pieces of the maxilla of the skeleton in the context 1337, in which we can appreciate the typical transverse lines of DEH. From A) to D): mandibular LC, RC, LI1 and RI1.

BIOLOGICAL PROFILE II (PALEOPATHOLOGIES).	CONTEXT Nº: 1825

- DENTAL DISEASES.

Between the dental diseases of this individual, we just could determine an advanced level of **TEETH WEAR** which affected de frontal dental pieces of both mandible and maxilla in an oblique buccal pattern, and the molars in a horizontal pattern over the occlusal surface. Since no marks of any kind where documented during the microscopic analysis, we assume that was just a consequence of the natural ATTRITION.

Also, called our attention the advanced level of **TEETH ROOT EXPOSURE**, with the recession of the alveolar bone, in both mandible and maxillary surfaces. Unfortunately, the big accumulations of carbonate concretions (taphonomy) all over the surfaces of both teeth and alveolar surfaces made impossible to determine any other condition (calculus, abscess, reactive bone, enamel hypoplasia, etc), so we couldn´t point to any specific disease.



Dentition of the context 1825. We can observe the root exposure, especially in the upper frontal teeth and in the sequence RPM2-M3 of the mandible. No more pathologies where registered in this case of study, since the conservation status didn´t allow us.

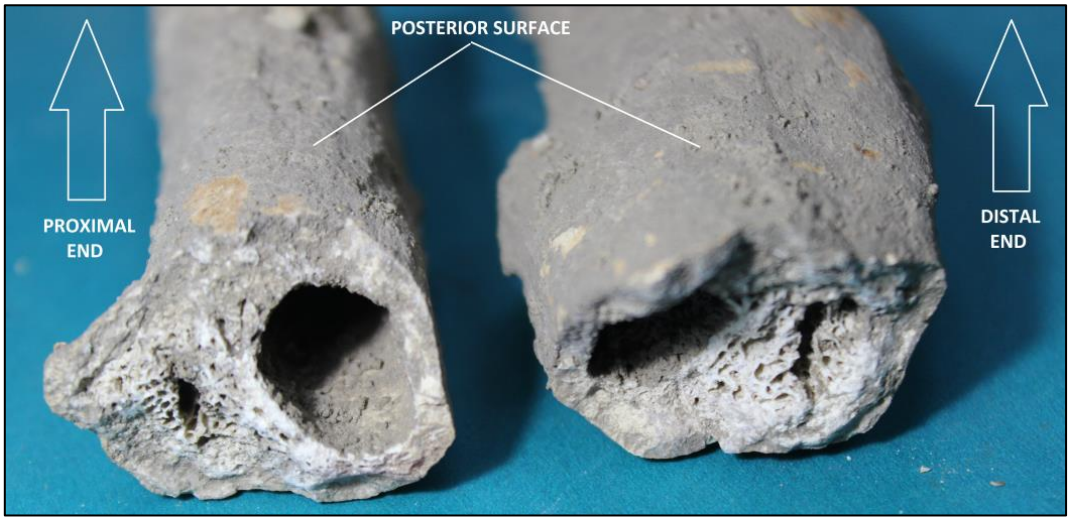
- TRAUMA.

The individual also presented a healed fracture of the left femur: on the midshaft of the bone we can observe a case of oblique/transverse fracture, healed but misaligned, which would have clearly affected to the mobility of the individual for the rest of his life time.

Even if unfortunately the fractured area was affected with an orthogonal modern fracture, this event allowed us to analyze the section of the bone in the area, getting interesting information: we could see, in fact, that the fracture was oblique and that it didn't repair in its original aligned position, but in a lateral superposition between both fragments, since both medullary cavities appear in a parallel position in the visible section.

We couldn´t determine the presence of a callus, what together with the formation of lamellar/woven bone, which is already being replaced in some areas with trabecular bone, make us thought that the process of fracture repair was in the latter possible phase (remodeling stage).

Of course X-Ray analysis was also used over this case, what allowed us to confirm the type of fracture and see more clearly the process of misaligned healing in this case of traumatism, as we can observe in the following pictures.



View of the section (contemporary fracture) of the healed oblique fracture present on the medial left femur of our individual, in which we can appreciate two parallel medullary cavities, as the result of the non-aligned repair of the traumatism.

Anterior (left picture) and posterior (right) views of the left femur of our individual, in which we can appreciate the healed oblique fracture in the medial diaphysis, which was repaired in a misaligned position.

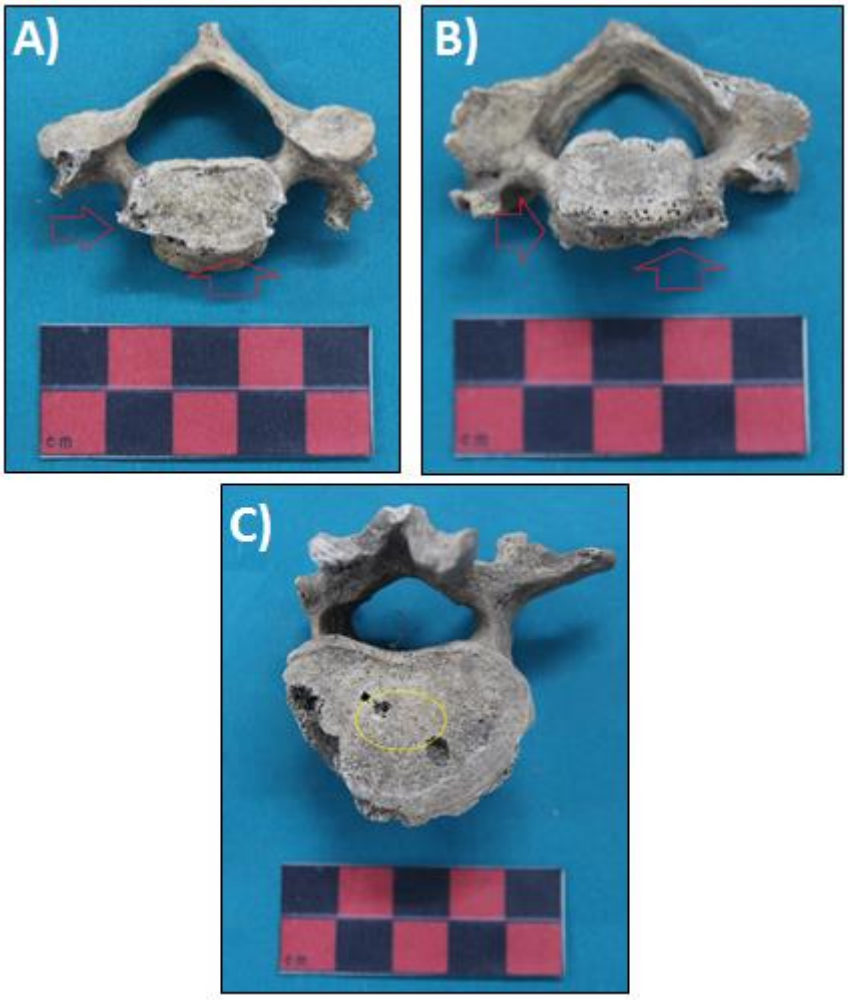
X-Ray: anterior view of the left femur of our individual, in which we can appreciate the oblique fracture in the medial diaphysis, healed misaligned (the line of fracture is marked between both arrows, separating both fragments, which can be identified through their medullar cavities).

BIOLOGICAL PROFILE II (PALEOPATHOLOGIES).	CONTEXT Nº: 2240

- DEGENERATIVE JOINT DISEASES.

In the case of the context 2240 of Ille Cave, we could diagnose some degeneration signs in the vertebral column, in the few cases of vertebrae preserved. These small markers (some marginal lipping in the cervical area and a light Schmorl´s node in the only lumbar vertebrae preserved, in the inferior surface of the vertebral body) could point to pathological facts but, however, are not enough for pointing to an specific disease.

In the same way could point the reactive bone documented in the guiding ridge of the left ulna, possible marker of a light degeneration of the elbow joint. However, no other signs of degeneration where documented in any other joint of both arms, so again we haven´t got enough proves for determine a clear diagnosis.



A) and B): Marginal lipping registered over the vertebral bodies of two different cervical vertebrae (red arrows). C): Schmorl´s node from the only lumbar vertebrae conservated (inferior view, yellow circle). Unfortunately, the conservation status of the rest of vertebrae didn´t allow us to determine their position in the column.

Reactive bone registered over the guiding ridge of the lef ulna of the individual from context 2240, possible degenerative process.

BIOLOGICAL PROFILE II (PALEOPATHOLOGIES).	CONTEXT Nº: 2247

- DEGENERATIVE JOINT DISEASES.

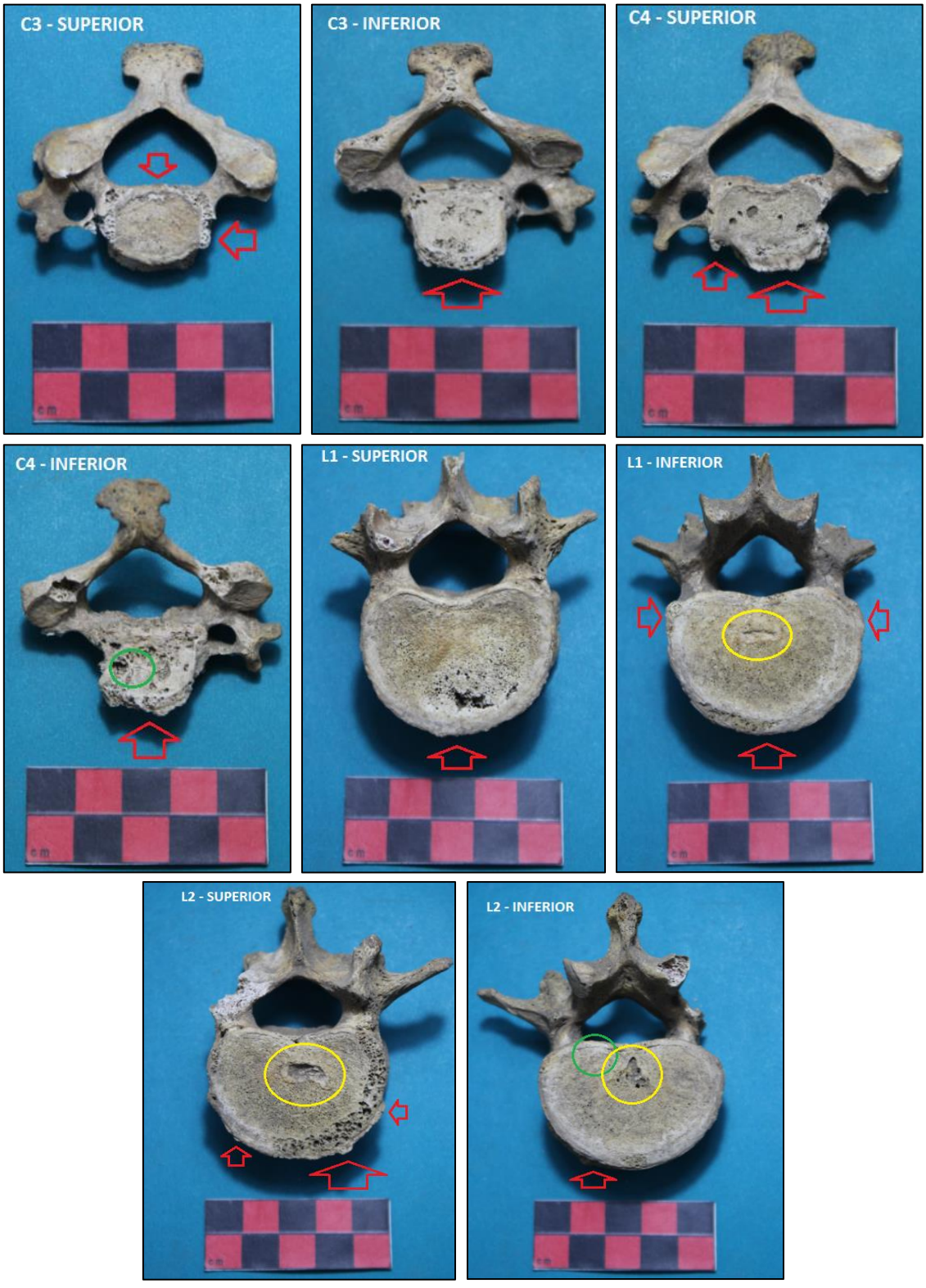
In the case of the context 2247 of Ille Cave, we could diagnose that suffered a case of **OSTEOARTHRITIS**, which, in this case, was located just in the vertebral column. As we can see below, two of the three typical markers of this pathology are present in several vertebrae:

ASPECT	LOCATION
Osteophytes and bonny plaques	Small nodules of reactive bone where documented in the surface of several vertebrae, over the superior and inferior surfaces of the vertebral bodies: C3-4, T10-12 and L3. **Marked in green color in the following images.*
Marginal lipping	Located in several vertebrae: C3-4, T4-12 and L1-5. The lipping is generally associated to the edges (superior and inferior) of the vertebral discs, growing laterally from them as consequence of the mechanical action between the surfaces of both following bones, caused by the lost cartilage of the joint between them. **Marked with red arrows in the following images.*
Eburnated surfaces	We couldn´t determine the presence of any eburnated surface in 2247 vertebrae, but the presence of both the previous markers seems enough for the diagnosis.

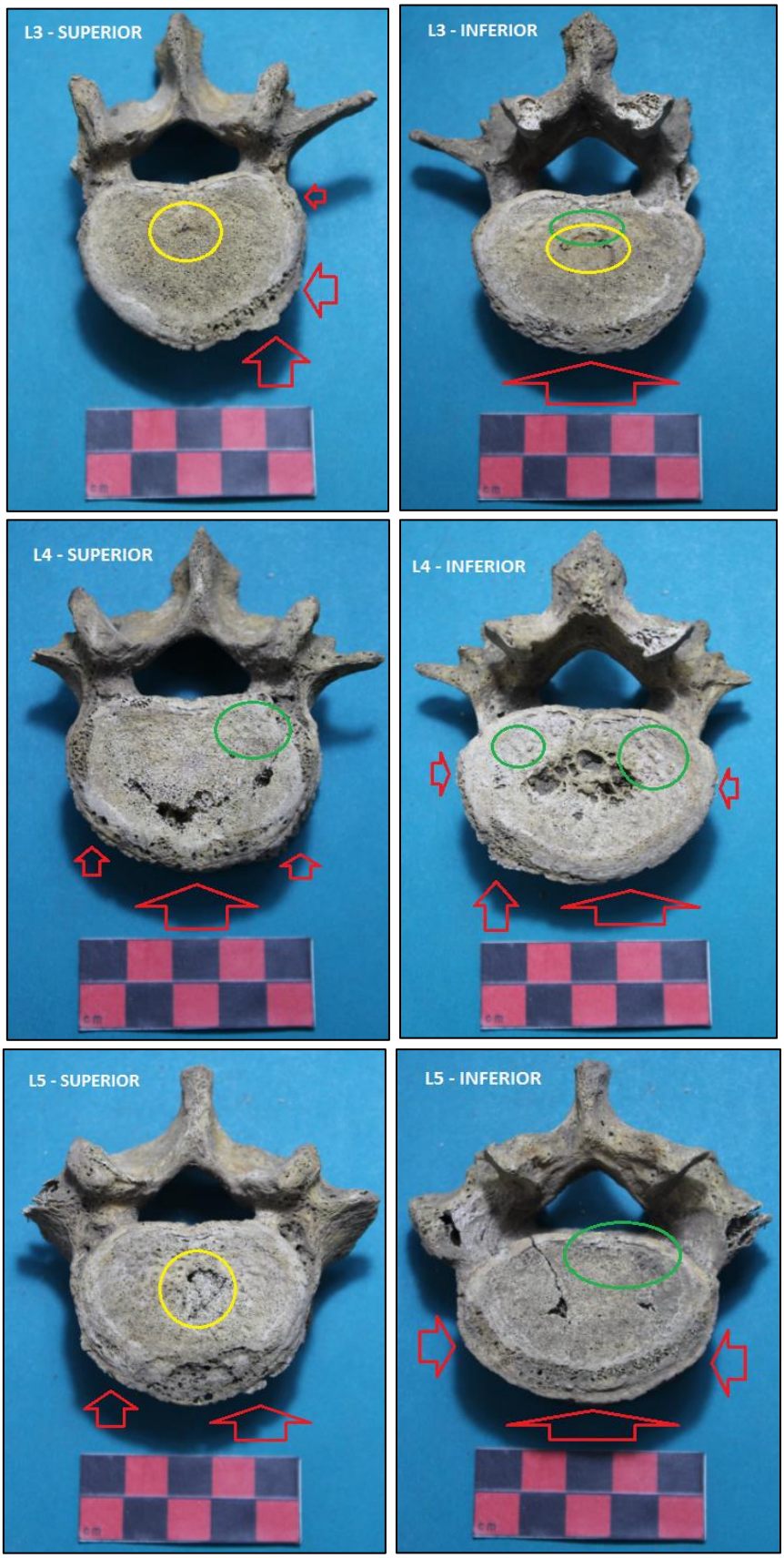
Also was possible to identify several **SCHMORL´S NODES** in all the vertebrae of the lumbar area (L1-5), located in all the cases in the central vertebral body superior and inferior surfaces, and which appear as small pits or depressions over the bone surface (caused by the inflammation and protrusion of the cartilage of the intervertebral disc thought the vertebral body endplate and into the adjacent vertebrae). Even if Schmorl´s nodes can be linked also the osteoarthritis in some cases (can be part of its symptomatology), is not necessary that this occurs, so we registered both cases as different paleopathological evidences. We can observe them also in the attached photography (next page, marked in yellow).

- TRAUMA.

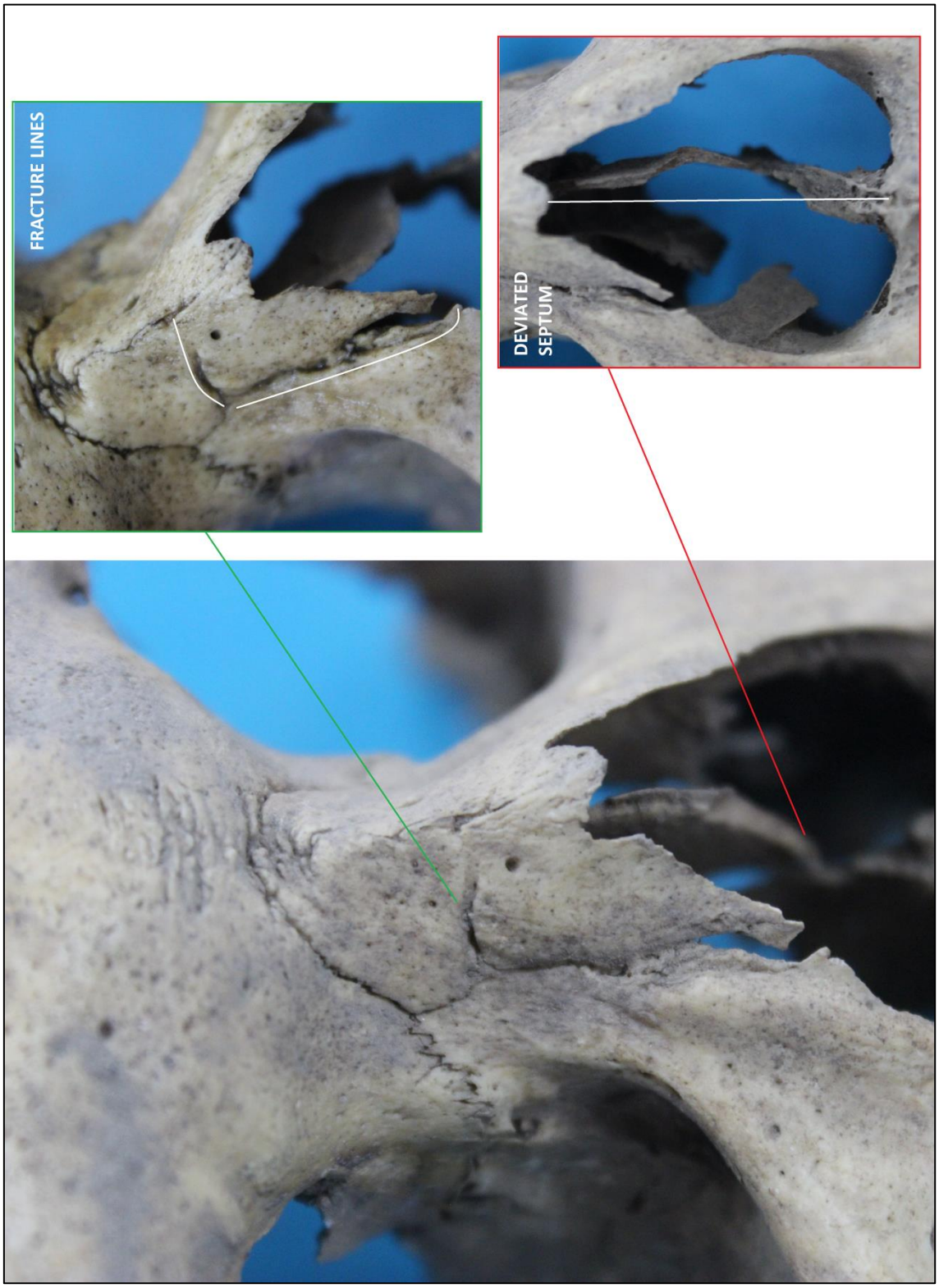
We also registered a case of a **HEALED NASAL FRACTURE** in this individual, which we could determine by the presence of an horizontal groove which crossed the right nasal bone (fracture line), the irregularities in the articulation with the opposite nasal and the right maxilla (the nasal fragmented piece healed in a different position to the original one) and also because of the presence of a deviation in the vomer bone (the deviation of the nasal septum is normally present in this cases of nasal trauma).



In this series of photography, we can see several cases of osteophytes (marked in green circles) and marginal lipping (red arrows) over the bodies of several vertebrae (C3-4 and L1-2), considered markers of osteoarthritis, as well as some Schmorl´s nodes in the lumbar area vertebrae (marked in yellow circles).



Vertebrae L3-5: we can see again the different markers of osteoarthritis (osteophytes, in green, and marginal lipping, pointed with red arrows), and again more Schmorl´s nodes (in yellow).



Detail images of the healed fracture of the right nasal bone in the individual 2247 of Ille Cave. We can appreciate the healed fracture lines (green chart) ant their irregular outline, and also the associated deviation of the vomer (red chart), frecuent in this kind of lesions.

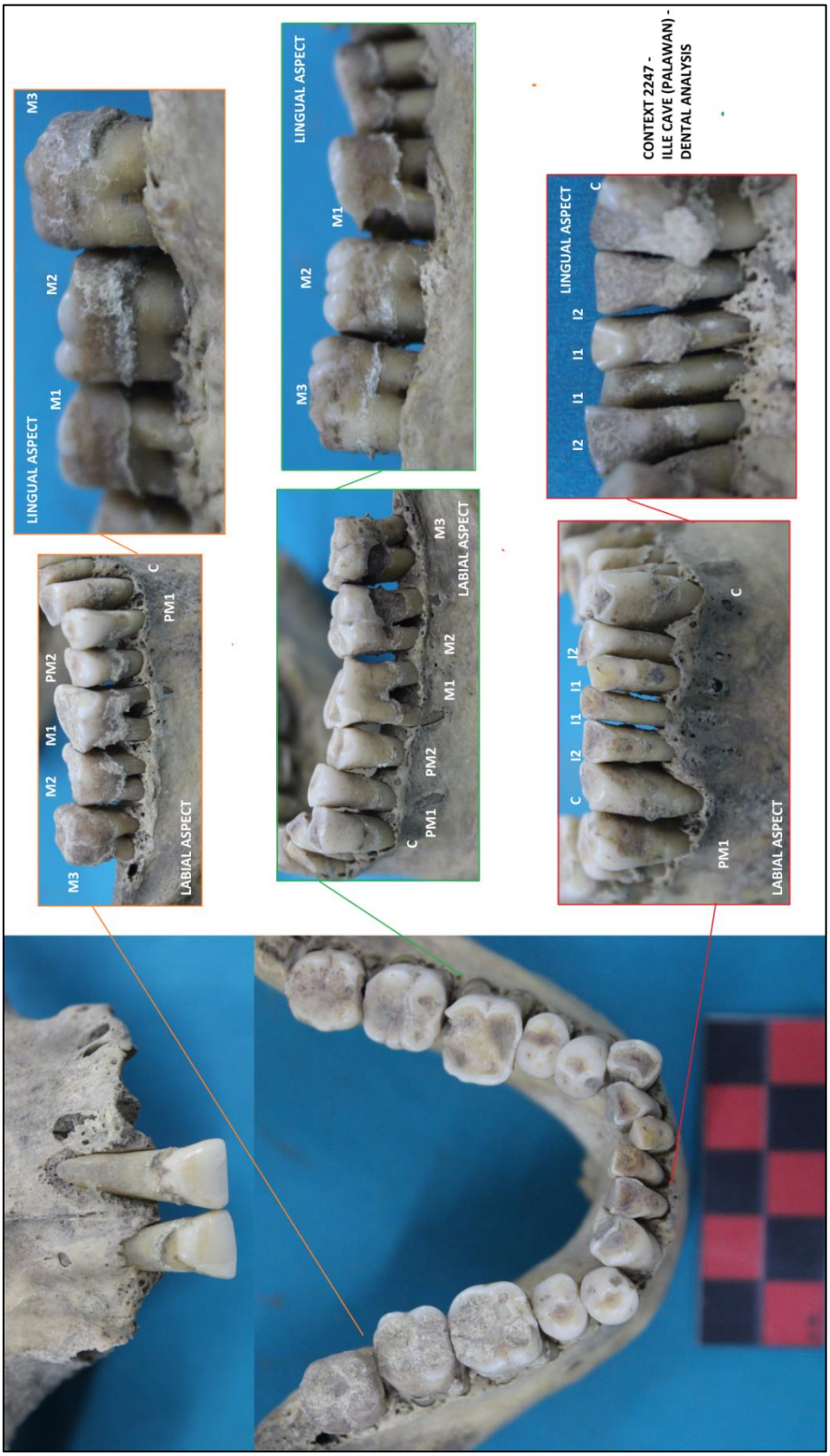
- DENTAL DISEASES.

In the individual of the context 2247 from Ille Cave, we could observe two different patterns of **TEETH WEAR**, in different areas of the mouth, and which had a different interpretation:

- In the deeper part of the mouth, the erosion of the dental pieces follows an occlusal pattern of wear in horizontal plane. As we can see in the mandible molars and first premolars, the horizontal wear has already arrived to the point of transforming the original shape of the dental pieces: the crowns have already disappeared, and the dentine starts to appear beneath the enamel loss. This kind of horizontal occlusal pattern corresponds to the natural ATTRITION: the wear of the dental pieces because of their friction with the opposite ones during the masticatory process.
- Instead, the frontal teeth of this individual present a different scenario in the mandible: all the mandibular incisives and the first premolars have an oblique pattern of wear, as normally happens because of the attrition. But, in this case, the surface appears curved in the labial aspect (macroscopically, is easy to observe this rounded shape of the enamel in the premolar area), what suggest a non-natural factor of erosion: this particular shape could be the result of the ABRASION, so the involvement in the process of a third element between both teeth files (abrasive element on the diet, object, etc). Comparing this case with ethnographical studies made over other contemporaneous native populations (Ex: Inuit, Australian aborigines, etc), we noticed that this wear pattern is normally associated with the development of some specific cultural practices or economic activities. We could determine the presence of a **POSSIBLE CASE OF USE OF THE FRONTAL TEETH AS THIRD HAND**. The analysis of the mandibular frontal teeth in the microscope also gave us some interesting clues: we could register a microrotures of the enamel of LI2, which goes over all the labial aspect of the tooth, from the occlusal edge to the root, in a vertical disposition which normally is related to a vertical strength made over these teeth line, from up to down. Again, the ethnographical comparative allowed us to give a possible explanation: the **WORK OF ANIMAL SKINS AND LEATHERS** causes the same wear pattern in the Inuit, with the presence of the same shape and the same kind of microrotures, as a result of the vertical strength made over the animal skin, pulling down of it while holding it with the teeth.

Also we could notice the presence of **TEETH ROOT EXPOSURE** in this individual, caused by the alveolar bone recession of both maxilla and mandible, and which appeared together with a little of **REACTIVE BONE** and **POROSITY** around all the alveolar process of both maxilla and mandible. All this facts together could point to a possible case of infectious disease, more specifically to a possible case of periodontal disease.

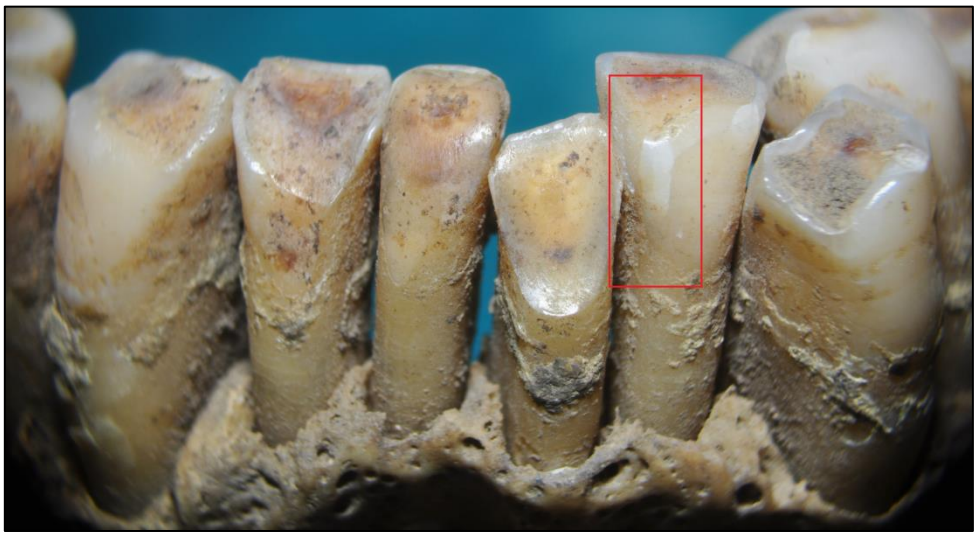
The idea of the buccal infection gains weight if we notice also the presence of some **CARIES** which appeared in the mandibular molars (in LM1 inter-dental aspect with



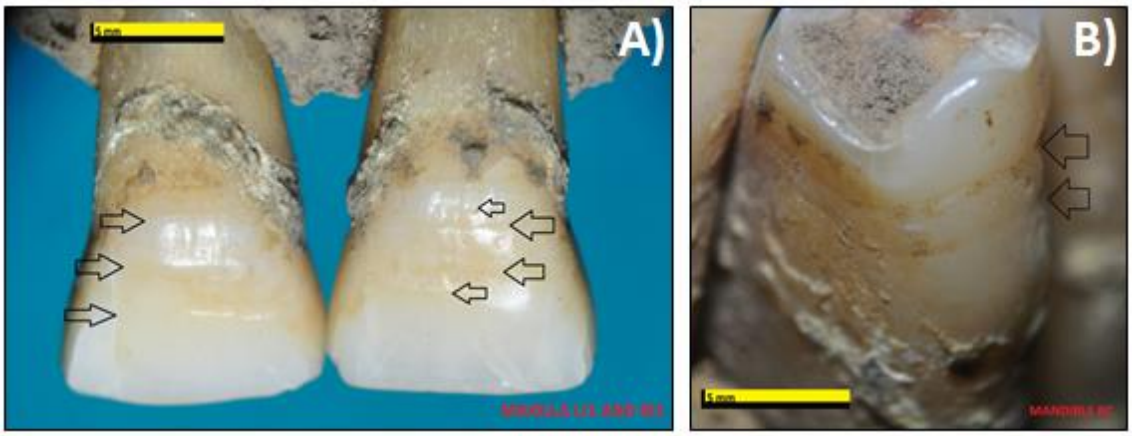
Dentition of the context 2247. We can observe the accumulation of calculus in the different teeth, the curved wear pattern of the frontal teeth, the root exposure and the signs of infection in the alveolar bone and the caries in the three molars of the right side of the mandible.

LM2, and in buccal-labial aspect in LM2 and LM3), and which had quite an advanced status: the pits where really deep, arriving in all cases to the center of the teeth, and covering almost all the lateral surfaces. Also **CALCULUS** was noticed in all the dental pieces preserved, distributed horizontally in bot labial and lingual aspects.

Finally, it has been also registered a case of **DENTAL ENAMEL HYPOPLASIA**, characterized by the typical transverse lines and grooves on the surface of tooth crowns, clearly visible in this case both macroscopically and under the microscope in maxillary first incisives of both sides (RI1 and LI1) and in the LC of the mandible.



Detail picture of the frontal dentition of the context 2247, in which we can appreciate the curved dental wear pattern in the labial aspect of the teeth (especially in the canines and premolars), and also the vertical microrotures in LI2 (red box). Is also possible to notice the enamel hypoplasia over the surface of LC.

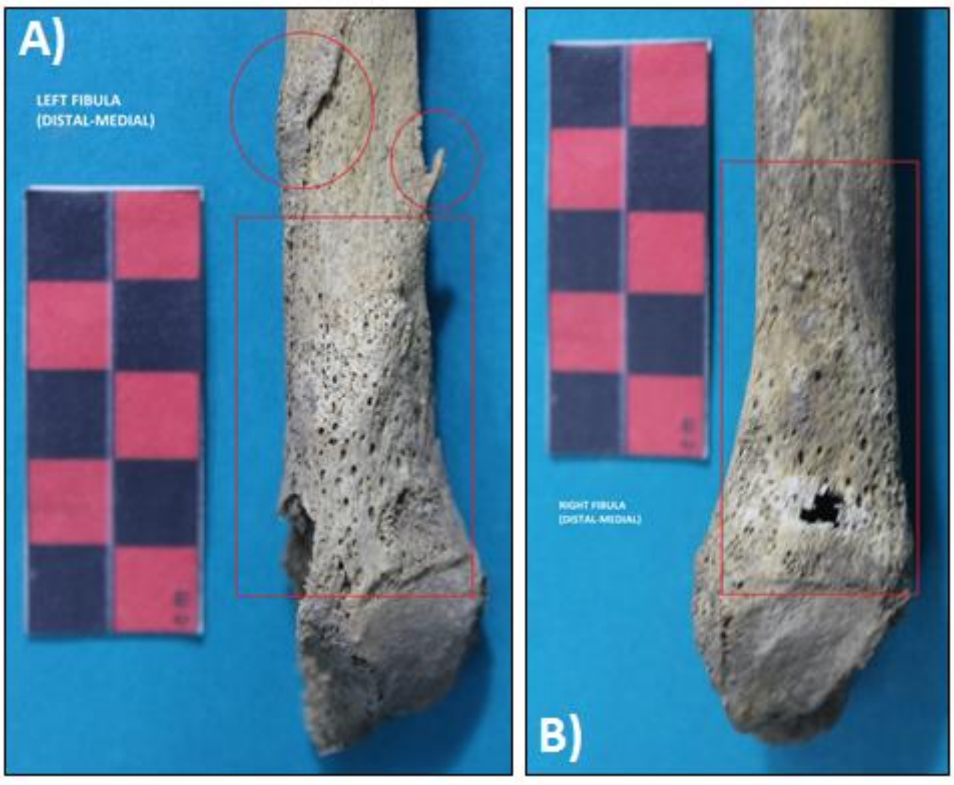


Results of the microscopical analysis made over several maxillary dental pieces of the skeleton in the context 2247, in which we can appreciate the typical transverse lines of DEH. A): maxillary LI1 and RI1. B): mandibular LC.

- INFECTIOUS DISEASES.

About the infectious diseases, is really interesting the case of the pathology registered in both limbs of this individual: the epiphysis of both legs (both femurs and tibiae) and arms (both humerus, left ulna and right radius) where covered with several areas in wich the original cortical surfaces where covered with an extra layer of new bone formations, normally in the shape of small plaques and fine pitting, giveing the bone a woven porous aspect. The disposition of this new bone tissue in longitudinal striations allowed us to determine a case of **PERIOSTITIS** in both arms and legs: the differential diagnosis is inmediate with other cases of infrectious diseases, because this particular organization of the new bone in paralel striae is typical and definitory of the periostitis. Also, some small osteophyte was doccumented in the distal left fibula (marked in a circle in the next photography), another characteristic wich normally comes associated with the periostitis.

Is interesting that the distribution of this new bone formations affects specially to the down limbs, and even more in the case of the tibia, another clue for the diagnosis, since normally this kind of infectious disease manifest stronger in the tibial diaphysis. The origin of the disease comes normally from the formation of microtraumatisms wich appear in the periostium of the long bones in the legs, caused by locomotor intense activities (for example, intense running: the vibrations caused for the constant impact of the limbs in the floor causes the microrotures). This microrotures will be the focus from where the infection will expand *a posteriori*.



New bone formation over the distal-medial surfaces of both left (A) and right fibulae (B), marker of the registered case of periostitis.

Areas affected by periostitis in the left femur of the individual 2247 of Ille (posterior view).

Areas affected by periostitis in the right femur of the individual 2247 of Ille (anterior view).

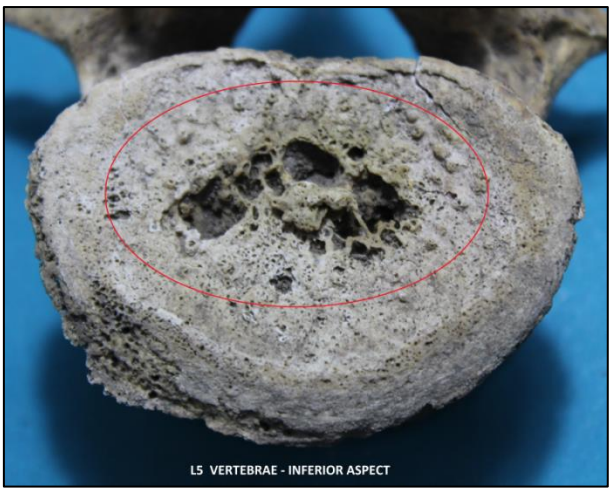
Areas affected by periostitis in the right femur of the individual 2247 of Ille (posterior view).

Periostitis over the left (upper images: anterior aspect-left, posterior aspect-right) and right (inferior image: anterior view) tibias of our individual.

Periostitis over both the left humerus (left picture: anterior view) and the right one (right picture: posterior view) of the individual from context 2247.

Areas in wich the periostitis manifest in the anterior epiphysis of the left ulna (left image) and the anterior right radius (right image) of the individual 2247.

Also, another signs of **NON SPECIFIC INFECTION** where registered in the vertebra L4: in the central inferior vertebral body we could find a big area of pits and reactive bone. Has no reflection in the upper L5.



Pits and reactive bone in the inferior aspect of the fifth lumbar vertebra of the individual 2247, signs of a possible infectious process.

- NON-SPECIFIC DISEASES.

Finally, another pathology was registered in the pelvic gridle: the surface of the pubic simpysis of the right side presents several pits and irregularities, together with shape loss, what seems to be caused by a degenerative process. Also, the growth of new bone tissue contributed to the current alterated aspect of the bone.

Several options where take in account for the fdifferential diagnosis:

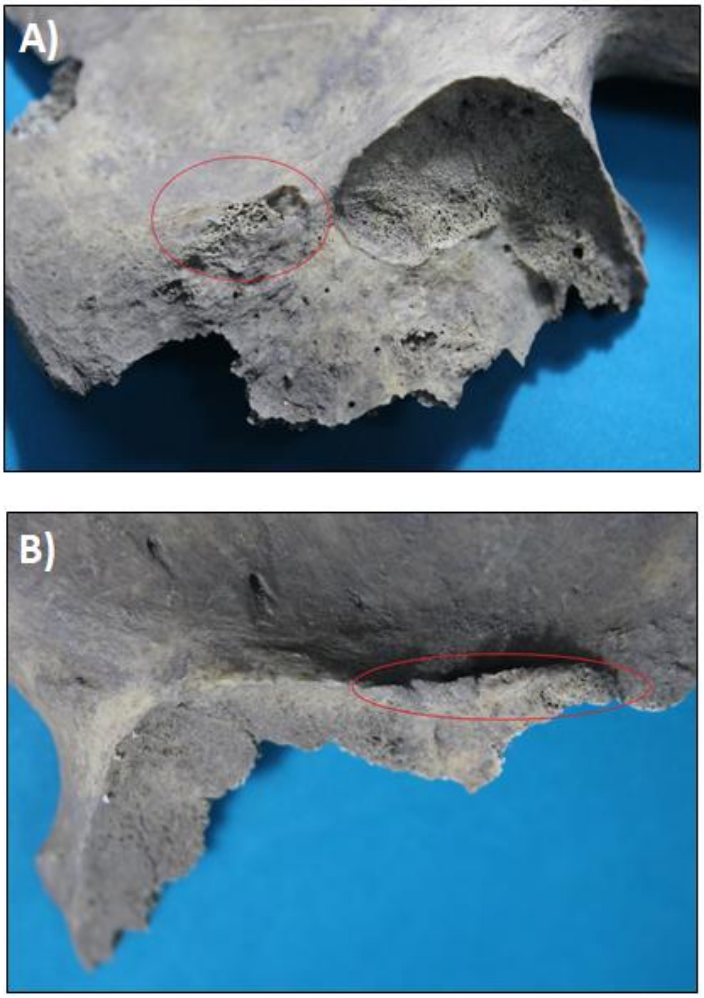
- Osteitis.
- Arthropaties.
- Non specific infectious disease (part of the generalized case wich we shown before).
- Trauma (Ex: pubic bone stress fracture) wich could cause a posterior infection.

After discarting the presence of any significative fracture, we opted for diagnose a **POSSIBLE PUBLIC OSTEITIS**, since is a pathology wich can appear as the result of infectious process (but not in every case: that´s why we decided to catalogue this case as a non-specific disease). Is normally frecuent in sportive people, specially in cases of people wich makes a lot of exercise with the down limbs (what would fit well with the previous case of periostitis wich we analyzed), an normaly with intense changes of rhythm (abrupt acceleration/deceleration, climbing activities, kick movements, etc). This high intensity of the activity makes the pubic are suffer quite big stress situations: the strong abdominal efforts can create microtraumatisms, wich would be the focus of the inmediate infection. But also the ilness can be originated after the introduction of bacteries in the organism, arround the abdominal area, so the activity explanation ins not definitive in any case.

In advances states of the pubic osteitis, the loss over the pubic simphysis outline is quite evident, like in our case of study, and also the symptoms can extend to the sacroiliac joint (in our case we could register reactive bone and marginal lipping in the same side joint, so the differential diagnosis worked, and even in the opposite side joint).

Is really unfortunate the fact than the other pubic simphysis is missing, cause normally this pathology is symetric (manifest in both sides of the body, as we could deduct from the fact that both sacroiliac joints present lipping and new bone growth). The same thing happens for the attachment area of the gracillis ligament, wich is also missing in this case, since is another area in wich the pubic osteitis manifest in advances states. This missing informations make us to avoid a definitive diagnosis, so we can just say that the pubic osteitis is probably related to the markers that we can observe in the pelvic gridle of this individual.

Detailed pictures of the pubic symphisis of the individual from the context 2247, in wich we can observe the degeneration of the bone surface and the complementary growth of new bone.



In advances states, like the one we have registered, the pubic osteitis manifest trought the reflection of the degenerative process in the sacroiliac joint. In the images, we can observe two perspectives of the marginal lipping in the right (A) and the left (B) sacroiliac joints.

- PHYSICAL STRESS MARKERS.

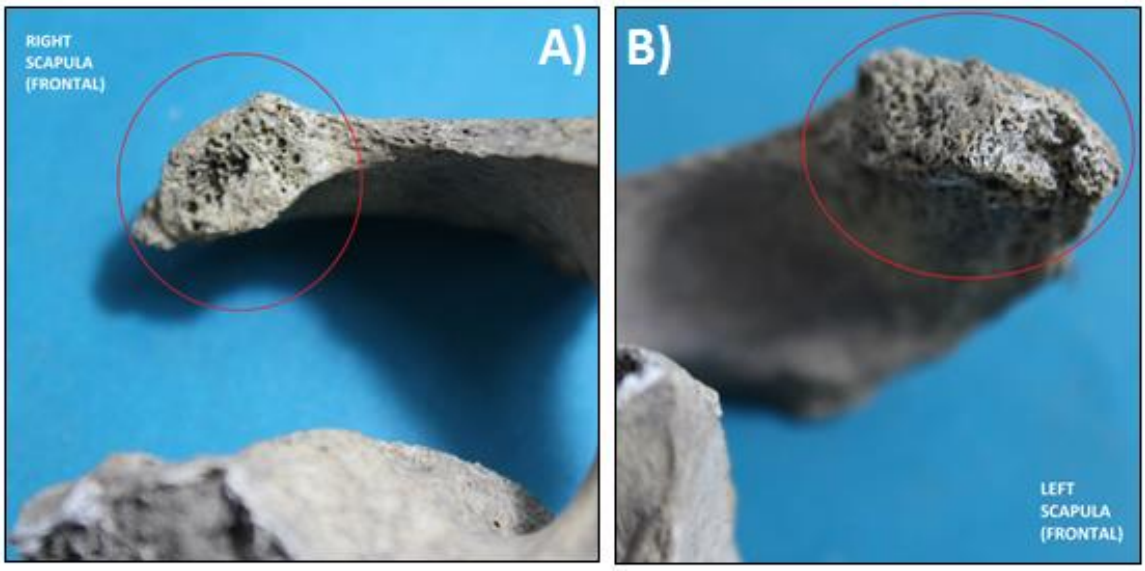
Finally, some signs of new bone groth where registered in the shoulder area of the skeleton:

- Clavicles: new bone accumulation over the ligament insertion areas (conoid and costoclavicular ligaments), and also arround the attachment of the deloid muscle.
- Scapulae: bilateral signs of new bone formation and small osteophytes over the acromion process of both scapulae.

For the differential diagnosis, two scenarios where present:

- Some kind of infection in the muscles and ligaments of the shoulder articulation.
- The alterations on the bone (new bone growth) as a response to an activity stress suffered in the area.

We pointed to a case of **OCUPATIONAL STRESS MARKERS IN BOTH SHOULDER ARTICULATIONS**, since the bone was growing in the ligament and muscular insertions of the clavicles and the articulation of them with both scapulae. Similar lesions have been identified in the literature with rowers or people wich supported considerable levels of stress in their shoulders (carring, lifting and padding activities). In this cases the hyperdevelopement of the muscles wich participate in the joint circular movement provoques the new bone formation at entheses and syndesmoses, as in this particular case, in order to stabilize the attachment.



New bone formation over the acromion process of both right (A) and left (B) scapulae in our individual.

Signs of new bone formation over both left (A) and right (B) clavicles of the individual from context 2447.